GROUNDWATER EXPLORATION AND TESTING - DUVERNAY AREA

ALBERTA ENVIRONMENT

WATER RESOURCES MANAGEMENT SERVICES

TECHNICAL SERVICES DIVISION

HYDROGEOLOGY BRANCH

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May, 1988

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ABSTRACT

This study was conducted at the request of the Wastes and Chemicals Division of Alberta Environment. The purpose of the project was to find a long-term groundwater source for the Hamlet of Duvernay.

Test drilling was conducted at six sites south of the hamlet to determine the water supply potential in the sandstone beds (Brosseau Tongue) of the non-marine Belly River Formation. The underlying marine Lea Park Formation is not considered to contain a sufficient amount of potable groundwater for use by the hamlet.

A site, 1.7 km to the southwest of the hamlet was found to have the potential to supply the hamlet with a sufficient amount of groundwater. The chemical analysis of the water indicates the groundwater has a total dissolved solids content of approximately 900 mg/l.

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INTRODUCTION

At the request of the Wastes and Chemicals Division, a test drilling program was conducted to find a long-term groundwater supply for approximately 40 people in the Hamlet of Duvernay.

The Hamlet of Duvernay is situated approximately 115 km east of Edmonton and 10 km north of Two Hills in LSD 16 of Section 27 and LSD 1 of Section 34 Township 55 Range 12 West of the Fourth Meridian. The hamlet is on the southern bank of the North Saskatchewan River. The topography increases in terraces from an elevation of 540 m a.m.s.l. at Duvernay to 587 m a.m.s.l. 3 km south of Duvernay.

Hydrogeological reports and water well drillers reports were reviewed to determine the hydrogeologic environment, then a test drilling program was conducted at six sites within 3 km of the Hamlet (Figure 1). In cooperation with the County of Two Hills, the six sites were drilled, electric logged and the aquifers tested for yield and sampled for water chemistry.

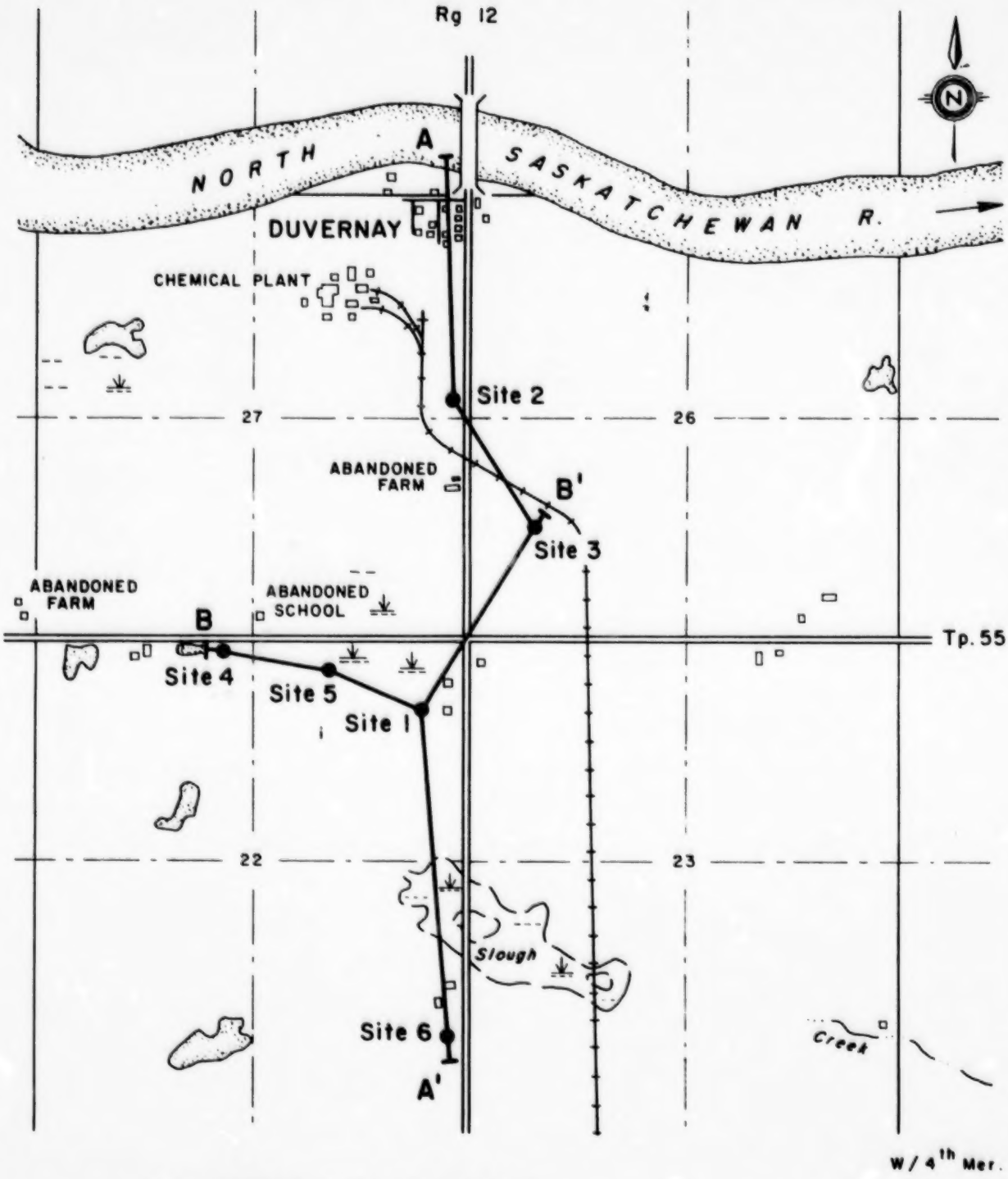


Figure 1

GROUNDWATER EXPLORATION – DUVERNAY

LOCATION PLAN

HYDROGEOLOGY

The uppermost bedrock in the area is the Upper Cretaceous Belly River Formation ranging in thickness from a few metres at the hamlet of Duvernay to 40 m at the higher elevations 2 km south of the hamlet. The hyrogeological cross sections (Figure 2) show the sandstone beds are thin close to Duvernay and to the east and tend to increase in thickness to the southwest. The base of the Formation is approximately 525 m a.m.s.l. (1725 ft.). The Formation is non-marine and consists of interbedded feldspathic sandstone, siltstone, and shale (Green, 1972).

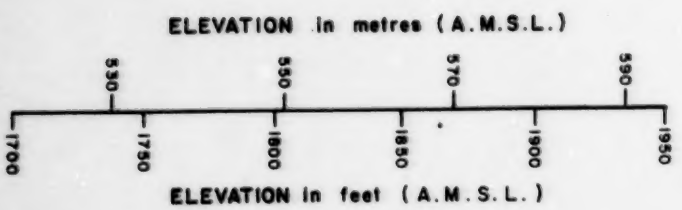
The sandstone beds of the Brosseau Tongue of this formation are the major source of groundwater for domestic supply in the area south of Duvernay (Currie and Zackarko, 1976). The groundwater chemistry of the aquifer water indicates it is quite mineralized with total dissolved solids ranging from 900 to 1800 mg/l. Some wells in the region have sulphates and/or nitrates which exceed the maximum acceptable concentrations (Health and Welfare Canada, 1987). The water is of the sodium bicarbonate sulphate type.

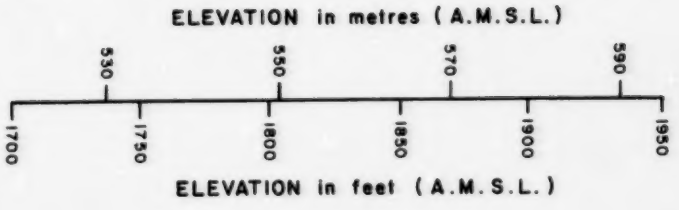
The Lea Park Formation underlies the Belly River Formation. The deposition is marine and is composed of shale and silty shale with some thin fine grained sandstone lenses. Groundwater yields are very low from these sandstones ranging from a few gallons per day to 2 gallons per minute (Le Breton, 1965).

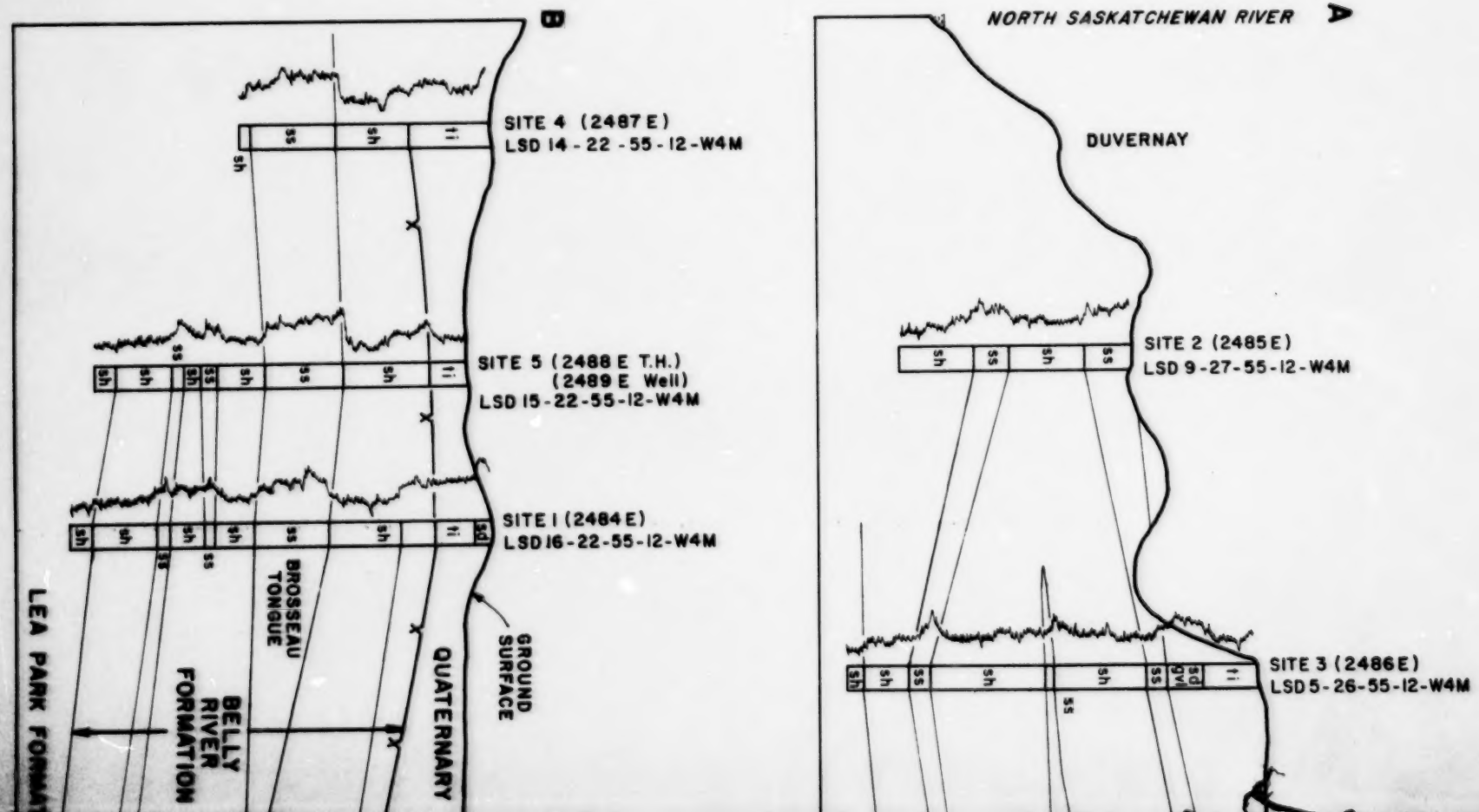
Bedrock is covered by drift that ranges in thickness from 1 m to 12 m and is comprised predominantly of till with thin sand beds present at some locations. The residents of Duvernay currently use dug or bored seepage wells in the shallow drift aquifers. The Belly River Formation sandstones have been eroded and are not present after the hamlet.

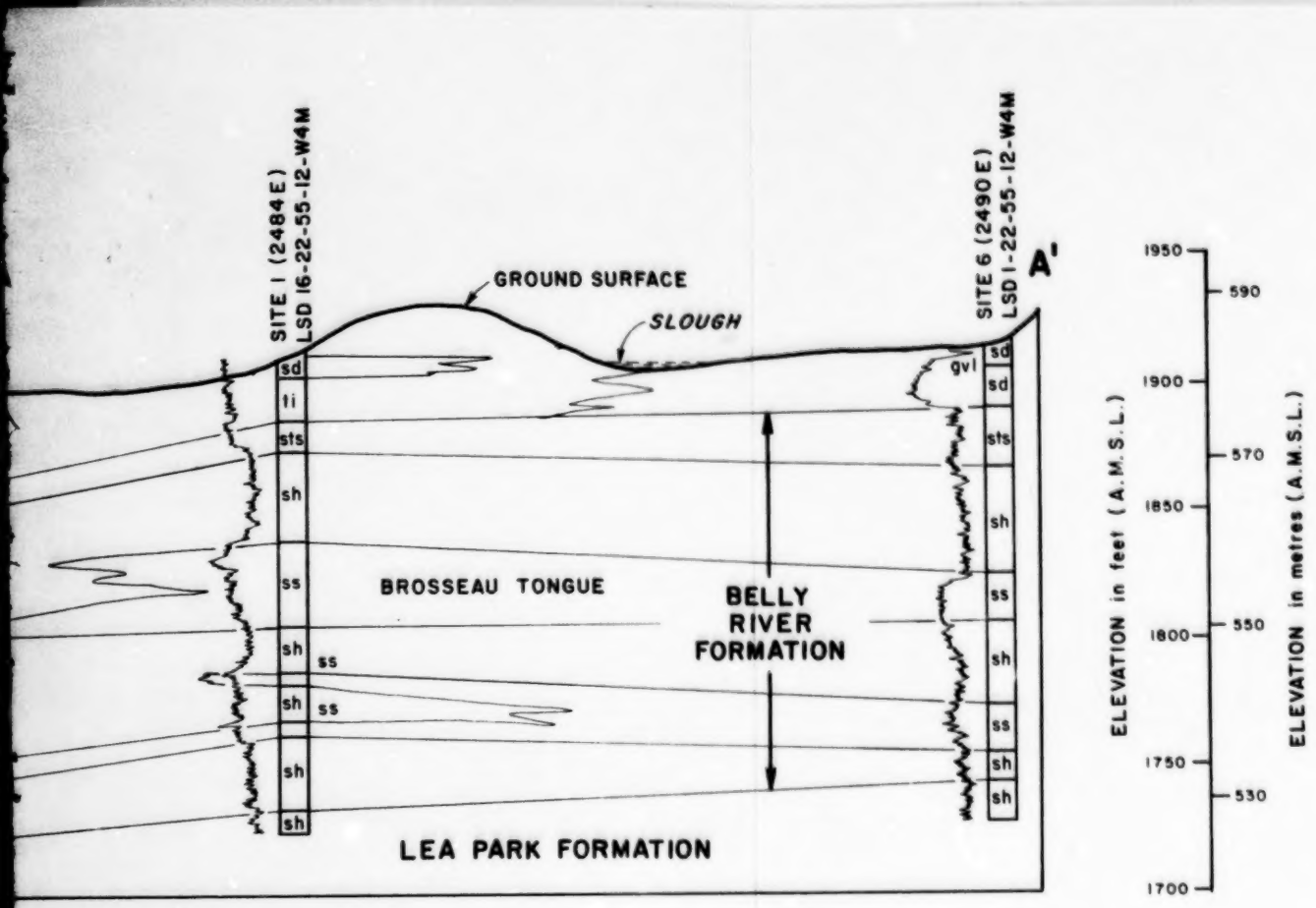
TEST DRILLING

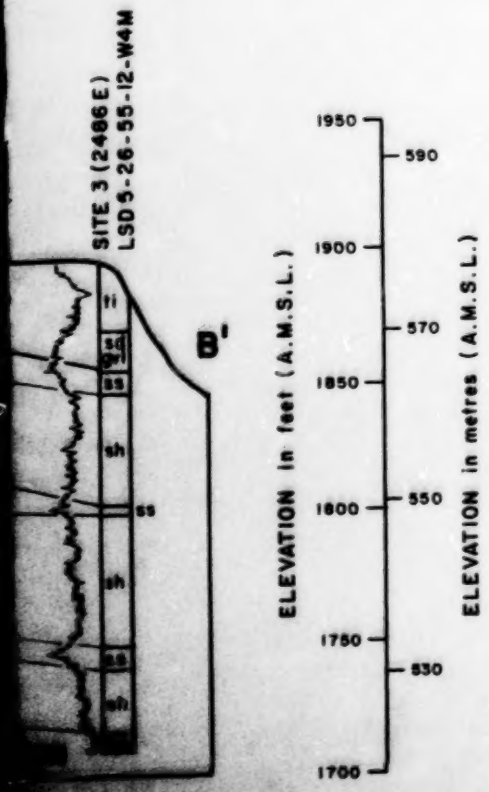
South of Duvernay, within 3 km of the hamlet, a total of six test holes were drilled and one observation well was installed. The test holes were cased when necessary, to obtain potential yield rates from the sandstone beds. The aquifers were tested by compressor air lift, and the flow rate periodically measured throughout the test. The recovery rate was then recorded to obtain transmissivity and the twenty year well yield. All test holes were electric logged then abandoned and sealed with Benseal.


ELEVATION in metres (A.M.S.L.)
530
550
570
590
1700
1750
1800
1850
1900
1950
ELEVATION in feet (A.M.S.L.)


ELEVATION in metres (A.M.S.L.)
530
550
570
590
1700
1750
1800
1850
1900
1950
ELEVATION in feet (A.M.S.L.)


B
SITE 4 (2487 E)
LSD 14 - 22 - 55 - 12 - W4M
SITE 5 (2488 E T.H.)
(2489 E Well)
LSD 15 - 22 - 55 - 12 - W4M
SITE 1 (2484 E)
LSD 16 - 22 - 55 - 12 - W4M
GROUND SURFACE
QUATERNARY
BELLY RIVER FORMATION
BROSSEAU TONGUE
LEA PARK FORMATION
NORTH SASKATCHEWAN RIVER
A
DUVERNAY
SITE 2 (2485 E)
LSD 9 - 27 - 55 - 12 - W4M
SITE 3 (2486 E)
LSD 5 - 26 - 55 - 12 - W4M
sh
ss
ti
sd
gv





LEGEND

ss - sandstone

sts - siltstone

sh - shale

ti - till

sd - sand

gvl - gravel

—— FORMATION, TONGUE BOUNDARY

Figure 2

HYDROGEOLOGIC CROSS SECTIONS

Site #1

At LSD 16-22-55-12-W4M a test hole was drilled to 55 m which penetrated the entire Belly River Formation and 3 m of the Lea Park Formation (Appendix A). A sandstone aquifer, the Brosseau Tongue of the Belly River Formation, was encountered from 22 to 31 meters below ground surface. The upper portion of the hole was cased to 13 m, then the aquifer was air tested. It produced about 11 L/min. (2.5 igpm) initially and improved to between 14-18 L/min. (3-4 igpm). A water sample was analysed by the Alberta Environment Lab in Lethbridge. The results are shown in Table 1. The water is quite mineralized with a total dissolved solids content of 968 mg/l. The sodium adsorption ratio (S.A.R.) is very high, (Table 1, Appendix C). The water is of the sodium bicarbonate type.

Site #2

At LSD 9-27-55-12-W4M a test was drilled to 30 m. This well encountered sandstone from 16-21 m however the air test yielded only 2-3 L/min. (0.5 to .75 igpm).

Site #3

At LSD 5-26-55-12-W4M a test hole was drilled to 54 m encountering sandstone from 12-14 m, 26-27 and 42-45 m. Each sandstone was air tested, however the yield did not exceed 4.5 L/min. (1 igpm).

Site #4

At LSD 14-22-55-12-W4M a test hole was drilled to 33 m and cased to 20 m. A sandstone aquifer was found between 20-32 m from ground surface and air tested indicating a yield from 55-70 L/min. (12-15 igpm). Two water samples were taken; one during the test and the other 3 days later. The chemical analysis indicates the water is quite mineralized with a total dissolved solids content of 943 mg/l. This water was similar to that of site 1. The iron concentration was much lower. The S.A.R. was still very high.

TABLE 1: GROUNDWATER CHEMICAL QUALITY*1

PARAMETER	MAXIMUM ACCEPTABLE CONCENTRATION*	SITE 1 16-22-55-12-4	SITE 4 14-22-55-12-4	SITE 4 14-22-55-12-4	SITE 5 15-22-55-12-4
Source		Cased testhole	Cased testhole	Cased testhole	Observation Well
Sample Date		April 27, 1988	April 29, 1988	May 2, 1988	May 5, 1988
Calcium	---	15	7	10	12
Magnesium	---	5	1	2	3
Hardness, total $CaCO_3$	---	58	24	32	43
Sodium	---	363	363	338	359
Potassium	---	5	3	3	4
Carbonate	---	23	19	0	20
Bicarbonate	---	762	708	659	722
Alkalinity, Total $CaCO_3$	---	663	612	540	625
Iron	---	1.89	<0.01	0.40	0.51
Fluoride	1.5	0.71	0.40	0.10	0.68
Sulphate	500	143	168	181	157
Chloride	---	37	33	29	37
Nitrate & Nitrite N	10	<0.07	<0.07	<0.07	<0.07
Ammonium N	---	1.79	1.01	1.4	1.75
Total Dissolved Solids	---	968	943	889	949
Electric Conductivity*5		1.55	1.51	1.45	1.54
pH*3	---	8.40	8.40	8.07	8.46
Sodium Adsorption Ratio*3	6*4	20.8	32.6	26.2	23.9

*1 - Unless specified otherwise
*2 - Guidelines for Canadian Drinking Water Quality 1987
*3 - Dimensionless
*4 - McNeeley et al (1979)
*5 - Deci Siemens/m

Site #5

At LSD 15-22-55-12-W4M a test hole was drilled to 49 m. An air test yielded about 27 L/min (6 igpm) from a sandstone aquifer from 17-26 m below ground surface. An observation well was installed in this aquifer and a two hour pump test, with a two hour recovery test, had a calculated transmissivity of 10.6 m^2/d (709 igpd/ft) and a twenty year well yield of 30 L/min (6.6 igpm) from the pumping interval (Appendix B). A transmissivity of 7.65 m^2/d (513 igpd/ft) and twenty year well yield of 22 L/min (4.8 igpm) was calculated from the recovery interval. A water sample was collected during the pump test for analysis (Table 1). The water quality is similar to the site 4 samples.

This well was constructed by cementing 14 cm diameter steel casing to 16.6 m. A 1.5 m length of stainless steel 7 slot well screen was sand packed with 12-20 seive frac sand from 18.9 to 20.6 m. The screen was attached to 3.7 m of 11 cm riser pipe and a lead packer wedged to the casing at 15.2 m (Appendix D).

This well will be incorporated into the Provincial Groundwater Observation Well Network for the purpose of monitoring hydraulic fluctuations and hydrochemistry over the next several years.

Site #6

At LSD 1-22-55-12-W4M a test hole was drilled to 55 m. This test hole encountered gravel to 3 m then a sand or sandstone to 6 m. Casing was set to 6 m to enable air testing of a sandstone from 27-33 m. However, when an air test was attempted, it blew out saturated sand as well as breaking the casing seal. The casing seal was regained by packing the annulus with Benseal. Another sandstone aquifer was present from 41-48 m, however this hole could not be air tested.

CONCLUSIONS

Six test holes and one observation well were drilled to the south of Duvernay. The Brosseau Tongue sandstone beds of the Belly River Formation are the main aquifers of the area. Groundwater yields obtained by air testing the aquifers ranged from 2 L/min. (0.5 igpm) 0.6 km south of Duvernay to up to 70 L/min (15 igpm) 1.7 km to the southwest. This latter site, (site #4) produced between 55 to 70 L/m (12-15 igpm) of water from a 12 m thick sandstone from 20-32 m below ground surface..

A groundwater monitoring observation well was installed 0.4 m east of site 4 for inclusion into the Provincial Groundwater Observation Well Network. A two hour pump test and a two hour recovery test were performed on the well. The calculated transmissivity from the pumping interval of the test was 10.6 m^2/d (709 igpd/ft) with a calculated twenty year well yield of 30 L/min (6.6 igpm). It is anticipated that the transmissivity and twenty year well yield at site 4 would be considerably higher because the air test yielded twice the flow rate of water.

Water samples collected from two test holes and the observation well indicated similar water types. The water is quite mineralized, with the total dissolved content ranging from 889 to 968 mg/l, and the sodium adsorption ratio is very high. The water is of the sodium bicarbonate type.

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APPENDIX A

GEOPHYSICAL LOGS

ALBERTA ENVIRONMENT HOLE #2484E
(DUVERNAY #1)
LSD 16-22-55-12W4M

ELEV. 1910' amsl.

DEPTH (feet)	LITHOLOGY
0 - 2	sandy topsoil
2 - 8	sand, coarse grained
8 - 16	till soft pebbly brown
16 - 22	till harder pebbly grey
22 - 24	sand coarse grained
24 - 72	shale dark grey
72 - 75	sandstone light grey soft bentonitic
75 - 82	sandstone hard light brown
82 - 84	sandstone softer light brown
84 - 102	sandstone softer light grey
102 - 118	shale

ran gamma, SP and PR logs
cased off surficial 42'
air lifted aquifer 2.5 igpm
blew 1 hour
stopped blowing 12:52 pm
w.l. 21:30 @ 12:59 pm
15:12 @ 1:16 pm
14:74 @ 1:19 pm
14:52 @ 1:22 pm
14:31 @ 1:24 pm
14:17 @ 1:26 pm
13:93 @ 1:32 pm
conductivity 1000 umhos

118 - 120	sandstone light grey
120 - 137	shale light grey
137 - 143	shale hard brown some good siltstone (brown) cuttings after hard ledge
143 - 147	sandstone light grey
147 - 178	shale hard ledge at 170'

Hole electric logged and gamma ray logged and sealed with BenSeal.

GEOPHYSICAL LOG

Alberta ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

PROJECT Groundwater Exploration
AREA Duvernay
WELL Test Hole No 1
LOCATION LSD 16-22-55-12 W4M

- [x] POINT RESISTANCE
- [x] SPONTANEOUS POTENTIAL
- [ ] NORMAL RESISTIVITY
- [ ] GAMMA
- [ ] CASING COLLAR LOCATOR
- [ ] TEMPERATURE GRADIENT
- [ ] DELTA TEMPERATURE
- [ ] MUD CELL

NTS MAP REFERENCE 73E13
G.L. ELEVATION 1920'

LOCATION ____ WELL ____ PROJECT ____

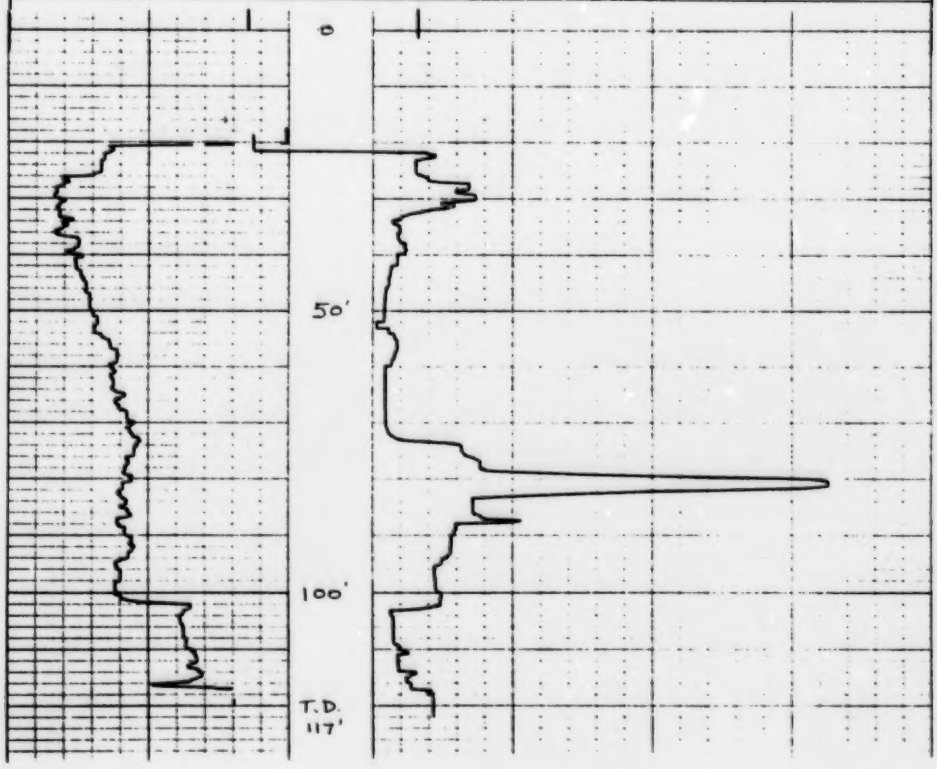
	Run No 1	Run No 2	MUD	Run No 1	Run No 2
Date	1988-04-22	1988-04-22	Nature	Natural/Lig Bent	Quik Gel
First Reading	117'		Density		
Last Reading	21'		Viscosity		
Footage Logged	96'		Resistivity		
T.D. (Driller)	120'		Circ Temp		
Bit Size	5⅞"		pH		
Casing Size	—				
Interval	—				
Bit Size					
Casing Size					
Interval					
			Logged by	S. Clare	
			Witnessed by	M. Cherniwchan	

REMARKS Logging Speed 60'/min

NOTE: Logged PRIOR TO CASING To 1142 Ft.

S.P. 2 mV/CD

P.R. 5 Ω/CD



GEOPHYSICAL LOG

RADBOOK PLACE
9820-106 ST.
EDMONTON, ALBERTA
T5H 2J6

Alberta
ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

- ☐ POINT RESISTANCE
- ☐ SPONTANEOUS POTENTIAL
- ☐ NORMAL RESISTIVITY
- ☑ GAMMA
- ☐ CASING COLLAR LOCATOR
- ☐ TEMPERATURE GRADIENT
- ☐ DELTA TEMPERATURE
- ☐ MUD CELL

LOCATION _____ WELL _____ PROJECT _____

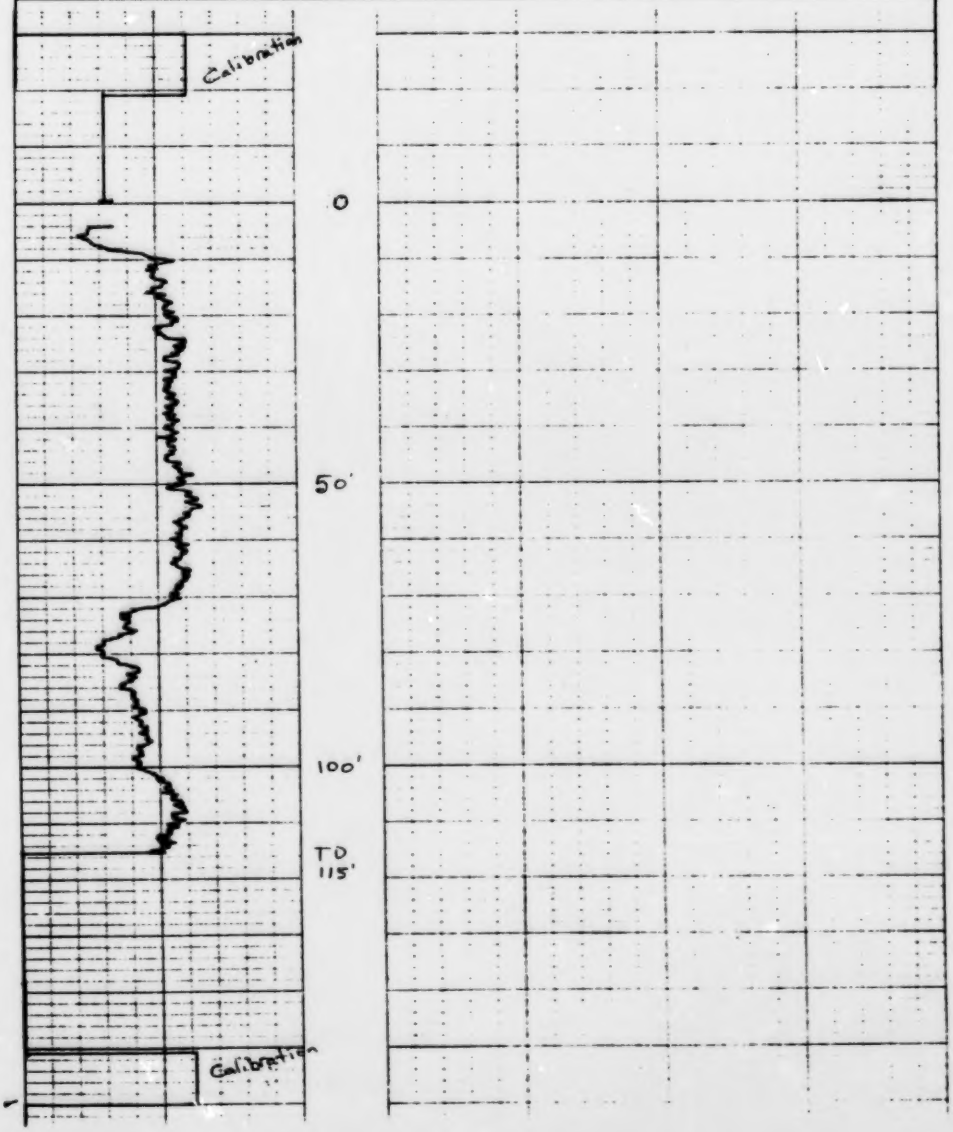
PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE #1
LOCATION LSD 16-22-55-12 W4M

NTS MAP REFERENCE 73E/13
G.L. ELEVATION 1920'

	Run No 1	Run No 2	MUD	Run No 1	Run No 2
Date	1988-04-27		Nature	Natural / 1 bg Quik-Gel	
First Reading	115'		Density		
Last Reading	4'		Viscosity		
Footage Logged	111'		Resistivity		
T.D. (Driller)	120'		Circ. Temp.		
Bit Size	5 7/8"		pH		
Casing Size					
Interval					
Bit Size					
Casing Size					
Interval					
			Logged by	S Clare	
			Witnessed by	M. Cheramachan	

REMARKS Logging Speed @ 12'/min
Time Constant 3 sec
Calibration 6:1 API

NOTE: LOGGED PRIOR TO CASING TO 42 FT.



GEOPHYSICAL LOG

Alberta ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

RESPONSE PLACE
9820 - 106 ST.
EDMONTON, ALBERTA
T5K 2J6

- [x] POINT RESISTANCE
- [x] SPONTANEOUS POTENTIAL
- [ ] NORMAL RESISTIVITY
- [ ] GAMMA
- [ ] CASING COLLAR LOCATION
- [ ] TEMPERATURE GRADIENT
- [ ] DELTA TEMPERATURE
- [ ] MUD CELL
- [ ]
- [ ]

LOCATION _____
WELL _____
PROJECT _____

PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE No. 1
LOCATION LSD 16-22-55-12 W4M

NTS MAP REFERENCE 73E/13
GL ELEVATION 1920'

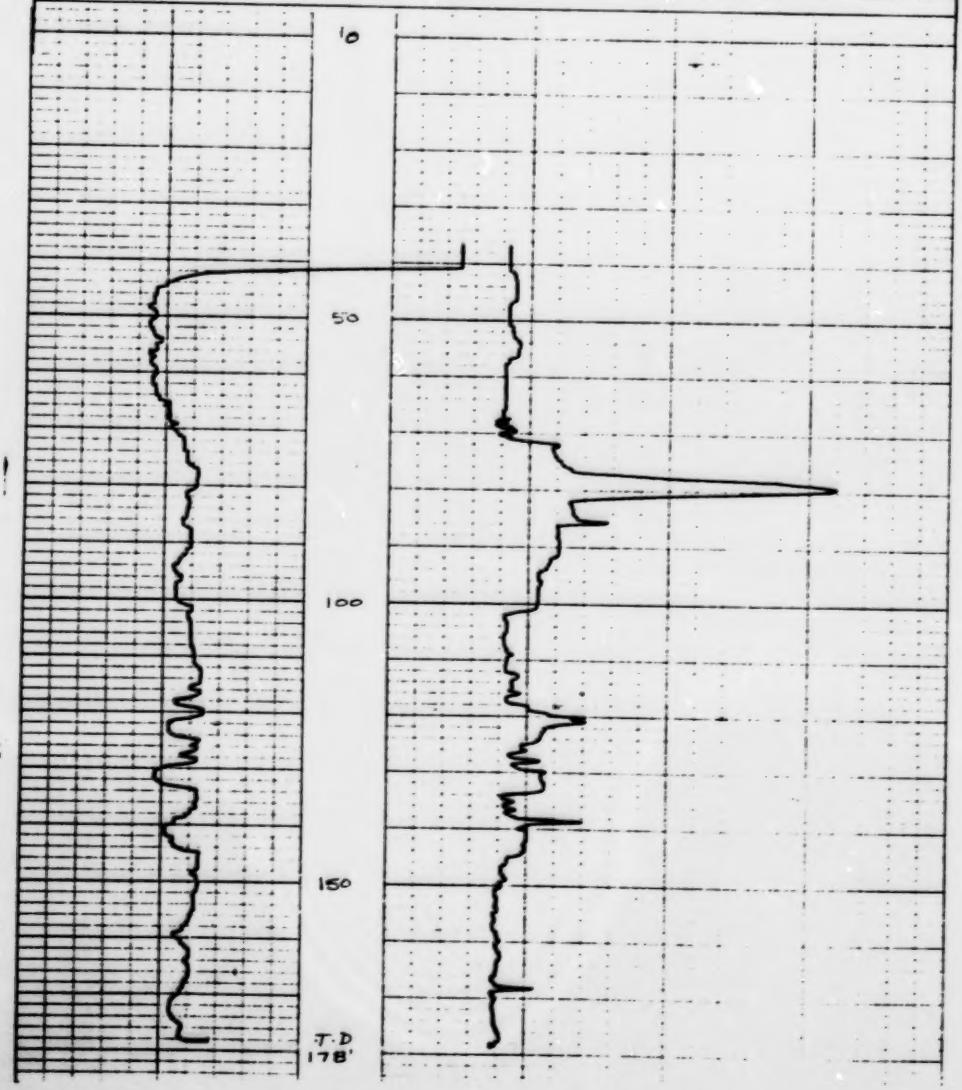
	Run No. 1	Run No. 2
Date		1988-04-27
First Reading		178'
Last Reading		41'
Footage Logged		137'
T.D. (Driller)		180'
Bit Size		6¼"
Casing Size		5 9/16"
Interval		0-42'
Bit Size		5 1/8"
Casing Size		OPEN
Interval		42-178'
		—

MUD	Run No. 1	Run No. 2
Nature	Natural Fluid	
Density		
Viscosity		
Resistivity		
Circ. Temp		
pH		
Logged by	S. Clark	
Witnessed by	M. Cherewchan	

REMARKS LOGGING SPEED 60'/min

S.P.
2 mV/CD

R.R.
5 Ω/CD



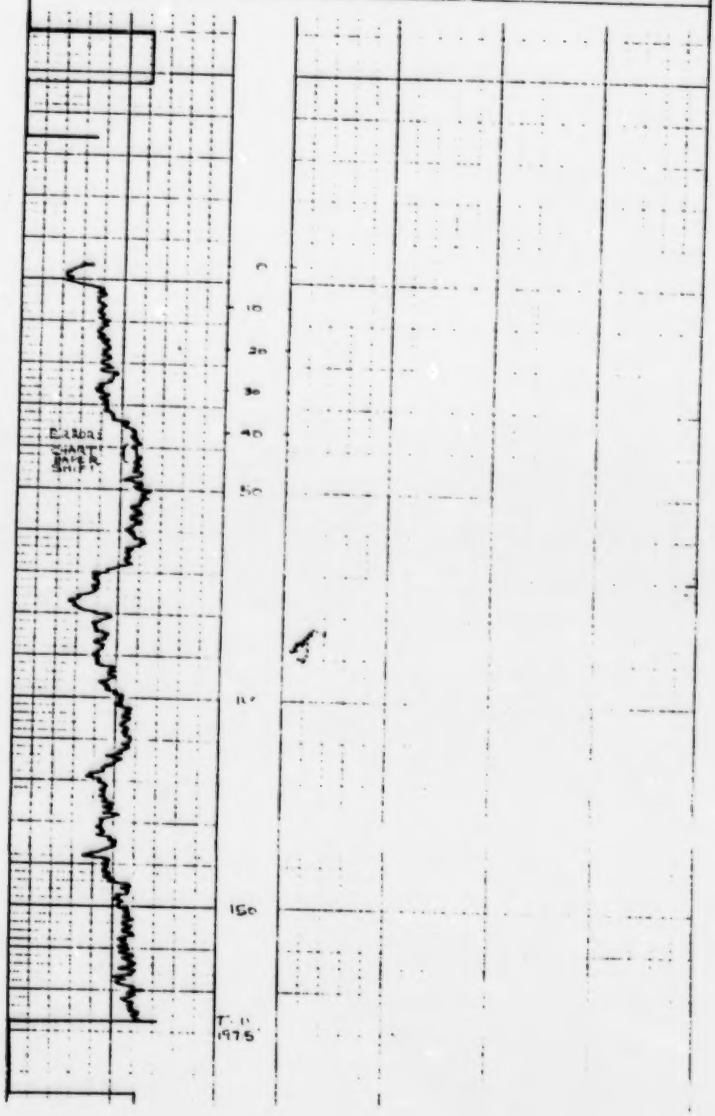
GEOPHYSICAL LOG

Alberta ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE #1
LOCATION 16-32-55-12 W4M

DATE 1988 04 27
ELEVATION 1920

Logging Speed @ 12'/min
Time Constant 3 sec
Calibration 6.1 API



ALBERTA ENVIRONMENT HOLE #2485E
(DUVERNAY #2)
LSD 9-27-55-12W4M

ELEV. 1840' amsl.

DEPTH (feet)	LITHOLOGY
0 - 2	sandy topsoil
2 - 12	sandstone orange-yellow oxidized
12 - 16	sandstone grey, soft
16 - 18	shale fractured brittle tan color
18 - 21	sandstone
21 - 48	shale brown sandstone seam around 45 ft.
48 - 53	shale
53 - 68	sandstone soft light grey
68 - 78	shale brown air test from 1/2 to 3/4 igpm
78 - 98	shale grey

Hole electric logged and gamma ray logged and sealed with BenSeal.

GEOPHYSICAL LOG

Alberta
ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

PROJECT GROUND WATER EXPLORATION
AREA DUVERAY
WELL TEST HOLE No 2
LOCATION LSD 9-27-55-12 W4M

NTS MAP REFERENCE 73L/13
G.L. ELEVATION 1840'

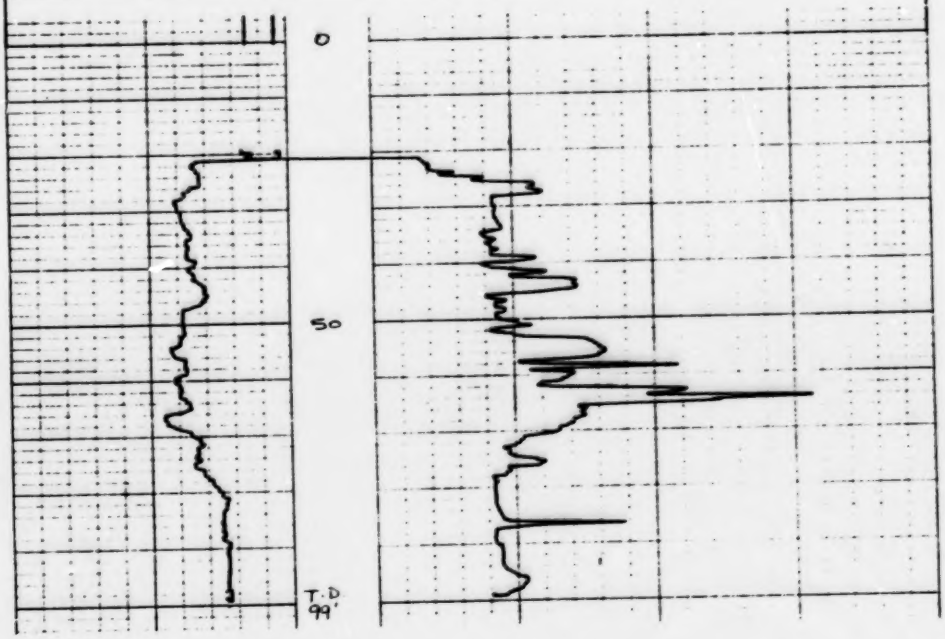
	Run No 1	Run No 2
Date	1988 Oct 28	
First Reading	99'	
Last Reading	21'	
Footage Logged	78'	
T.D. (Driller)	100'	
Bit Size	5 7/8"	
Casing Size	—	
Interval	—	
Bit Size		
Casing Size		
Interval		

MUD	Run No 1	Run No 2
Nature	Natural	
Density		
Viscosity		
Resistivity		
Circ Temp		
pH		
Logged by	S. Clare	
Witnessed by	M. Cherniwchan	

REMARKS Logging Speed 60'/min

S.P
2mV/CD

P.R.
2Ω/CD



GEOPHYSICAL LOG

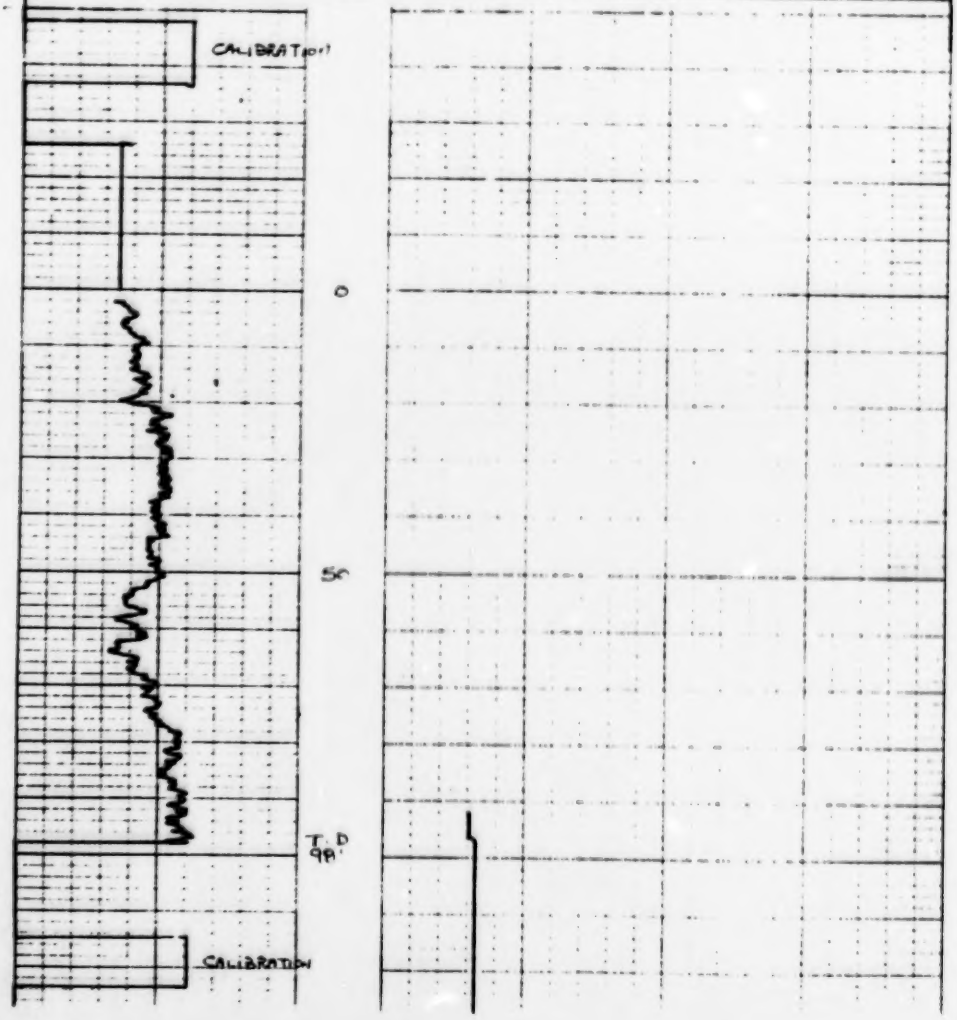
Alberta
ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE NO 2
LOCATION LSD 9-27-55-13 W4M

NTS MAP REFERENCE 73E/13
G.L. ELEVATION 1840'

	Run No. 1	Run No. 2		Run No. 1	Run No. 2
Date	1988 04 28			NATURAL / Log 99	
First Reading	98				
Last Reading	2'				
Footage Logged	96				
T.D. (Driller)	100'				
Bit Size	5⅞"				
Casing Size	5 9/16"				
Interval	0-21				
Bit Size					
Casing Size					
Interval					
			Logged by	S. Clare	
			Witnessed by	M. Cheeseman	

REMARKS Logging Speed 12'/min.
Time Constant 3 sec.
Calibration 6:1 API



ALBERTA ENVIRONMENT HOLE #2486E
(DUVERNAY #3)
LSD 5-26-55-12W4M

ELEV. 1895' amsl.

DEPTH (feet)	LITHOLOGY
0 - 2	topsoil
2 - 4	sand
4 - 12	sandy brown clay
12 - 24	clay
24 - 39	sand/gravel
39 - 46	sandstone
46 - 59	shale blowhole from 45' 1 igpm
w.l. 13:67 @ 12:15 pm	
13:32 @ 12:16 pm	
13:11 @ 12:17 pm	
11:97 @ 12:23 pm	
11:61 @ 12:25 pm	
11:04 @ 12:36 pm	
10:83 @ 12:51 pm	
10:68 @ 2:22 pm	
59 - 66	shale brown silty
66 - 88	shale brown slightly harder hard at 74'
88 - 90	sandstone
90 - 100	shale with thin sandstone lenses blow hole 1 igpm
100 - 138	shale siltstone dark brown
138 - 146	sandstone hard grey blew hole 1 igpm
146 - 158	shale
172 - 178	shale - siltstone looks like Lea Park Formation.

GEOPHYSICAL LOG

Alberta ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

- [x] POINT RESISTANCE
- [x] SPONTANEOUS POTENTIAL
- [ ] NORMAL RESISTIVITY
- [ ] GAMMA
- [ ] CASING COLLAR LOCATOR
- [ ] TEMPERATURE GRADIENT
- [ ] DELTA TEMPERATURE
- [ ] MUD CELL
- [ ]
- [ ]

LOCATION ____ TWP ____ PROJECT ____

PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE No 3
LOCATION LSD 5 - 26 - 55 - 12 W4M

NTS MAP REFERENCE 73E/13
G.L. ELEVATION 1880'

	Run No. 1	Run No. 2
Date	1978.04.25	
First Reading	177'	
Last Reading	3'	
Footage Logged	174'	
T.D. (Driller)	180'	
DH Size	4 7/8"	
Casing Size	5 5/16"	
Interval	0-15'	
Bit Size	5 1/8"	
Casing Size	OPEN	
Interval	15-180	

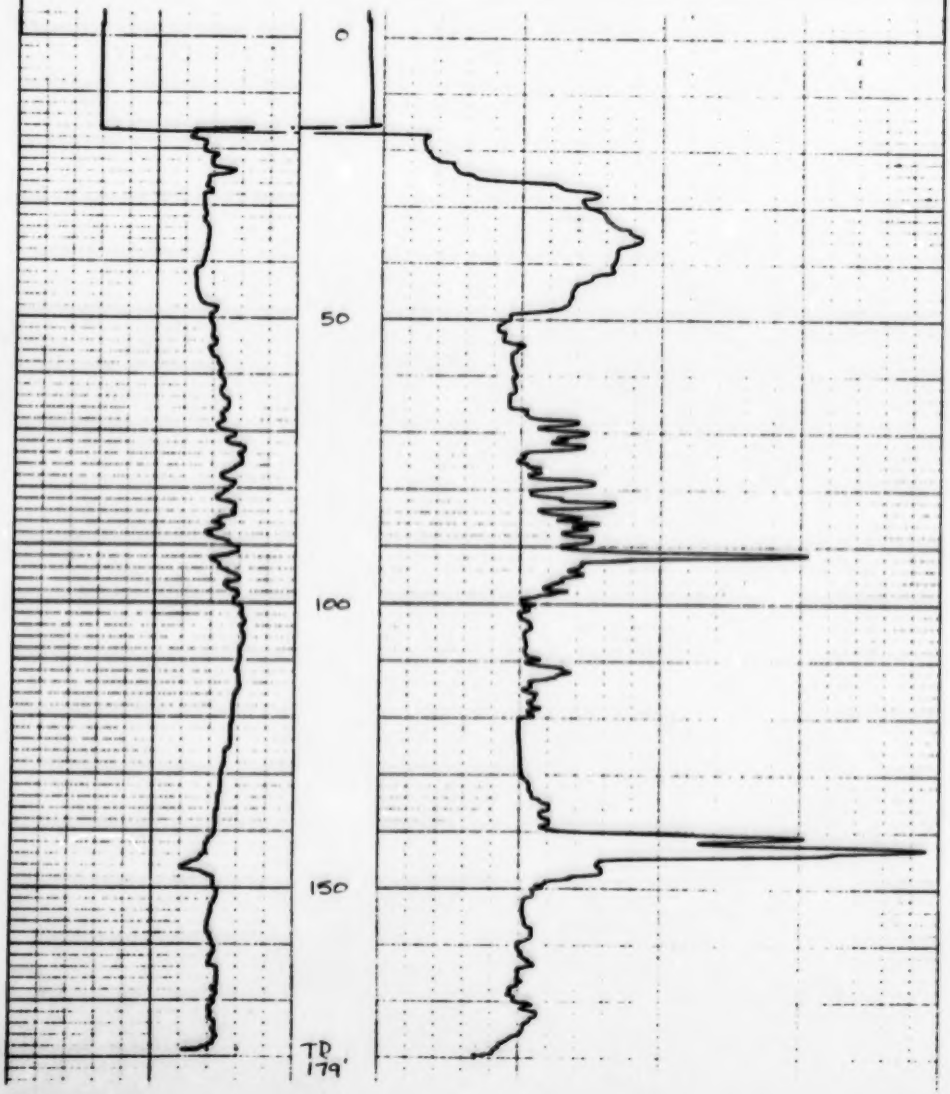
MUD	Run No. 1	Run No. 2
Name	Natural / Low gel	
Density		
Viscosity		
Resistivity		
Elev. Temp		
pH		

Logged by S. Clark
Witnessed by M. Cherniwchan

REMARKS Logging Speed 60'/min

S.P. 2mV/CD

P.R. 5Ω/CD



GEOPHYSICAL LOG

Alberta ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

- [ ] POINT RESISTANCE
- [ ] SPONTANEOUS POTENTIAL
- [ ] NORMAL RESISTIVITY
- [x] GAMMA
- [ ] CASING COLLAR LOCATOR
- [ ] TEMPERATURE GRADIENT
- [ ] DELTA TEMPERATURE
- [ ] MUD CELL
- [ ]
- [ ]

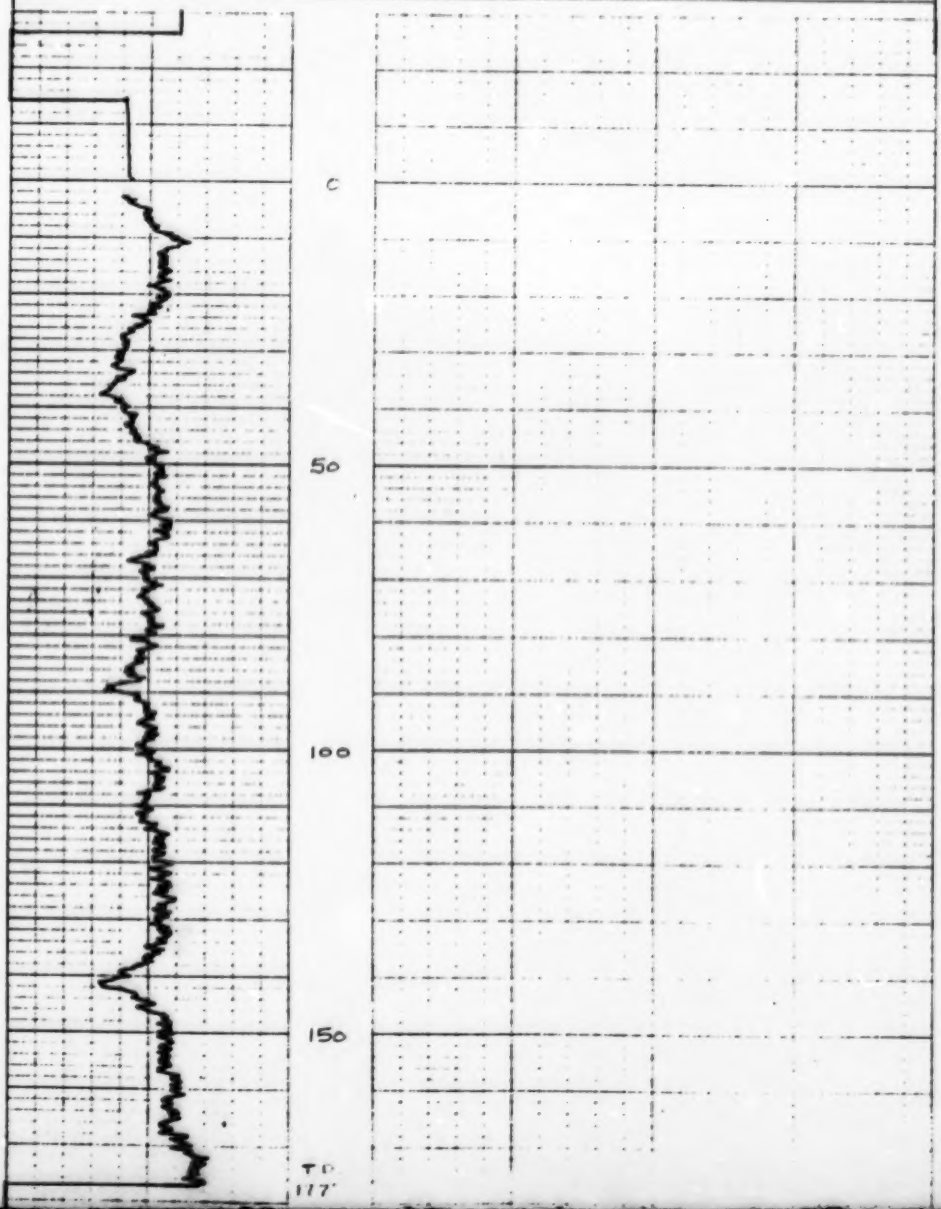
LOCATION ____ WELL ____ PROJECT ____

PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE No 3
LOCATION LSD 5-26-55-12 W4M

NTS MAP REFERENCE 73E/13
GL ELEVATION 1880'

	Run No 1	Run No 2	MUD	Run No 1	Run No 2
Date	1988 04 28		Nature	Natural / bg gel	
First Reading	177'		Density		
Last Reading	3'		Viscosity		
Footage Logged	174'		Resistivity		
T.D. (Driller)	180'		Elec Temp		
Bit Size	6 1/4"		pH		
Casing Size	5 9/16"				
Interval	0-18'				
Bit Size	5 1/8"				
Casing Size	OPEN				
Interval	18-180'				
			Logged by	S. Clare	
			Witnessed by	Dr Cherniwchan	

REMARKS Logging Speed 12'/min
Time Constant 3 sec
Calibration 6.1 API



ALBERTA ENVIRONMENT HOLE #2487E
(DUVERNAY #4)
LSD 14-22-55-12W4M

ELEV. 1910' amsl.

DEPTH (feet)	LITHOLOGY
0 - 1	topsoil
1 - 2	boulder
2 - 16	till sandy, pebbly with stones, stone at 2'; light brown oxidized
16 - 20	till sandy grey
20 - 34	till higher sand content grey
34 - 42	till grey
42 - 65	shale dark brown
65 - 79	sandstone, very soft, light grey
79 - 87	sandstone, slighty harder
87 - 89	sandstone, hard
89 - 95	sandstone
95 - 106	sandstone silty
106 - 108	shale

cased hole to 64 feet
air tested 12-15 igpm for 1.5 hours
took water sample
Gamma ray log only
Sealed hole with Ben Seal

GEOPHYSICAL LOG

OSBORNE PLACE
9820-106 ST
EDMONTON, ALBERTA
T5K 2J0

Alberta
ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

- ☐ POINT RESISTANCE
- ☐ SPONTANEOUS POTENTIAL
- ☐ NORMAL RESISTIVITY
- ☑ GAMMA
- ☐ CASING COLLAR LOCATOR
- ☐ TEMPERATURE GRADIENT
- ☐ DELTA TEMPERATURE
- ☐ MUD CELL
- ☐
- ☐

LOCATION
WELL
PROJECT

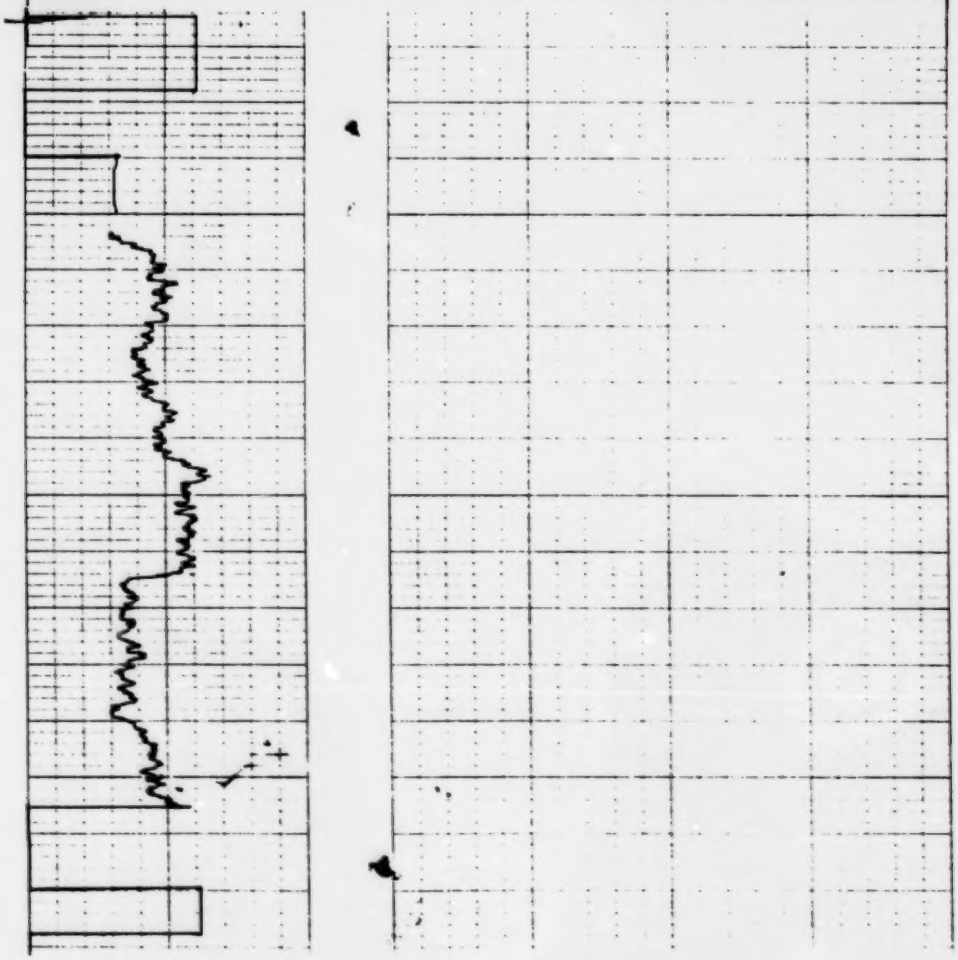
PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE No. 4
LOCATION LSD 14-22-55-12 W4M

NTS MAP REFERENCE 73E/13
G.L. ELEVATION 1910'

	Run No. 1	Run No. 2	MUD	Run No. 1	Run No. 2
Date	1988.05.02		Nature	FRESH AQUIFER WATER	
First Reading	105.5'		Density		
Last Reading	3.5'		Viscosity		
Footage Logged	102.0'		Resistivity		
T.D. (Driller)	108'		Circ. Temp.		
BH Size	6 1/4"		pH		
Casing Size	5 9/16"				
Interval	0-60'				
Bit Size	5 1/8"				
Casing Size	OPEN				
Interval	60-108'				
			Logged by	S. Clacs	
			Witnessed by	M. Cherniwchan	

REMARKS No S.P. or P.R. logs run. Hole had been air tested to determine aquifer yield.

GAMMA RAY
Logging Speed 12'/min
Time Constant 3 sec
Calibration 6 API



ALBERTA ENVIRONMENT HOLE #2488E
(DUVERNAY #5)
LSD 15-22-55-12W4M

ELEV. 1900' amsl.

DEPTH (feet)	LITHOLOGY
0 - 1	topsoil
2 - 14	sandy clay brown till stoney sandy
14 - 18	grey clay till stoney sandy
18 - 40	shale brown silty
40 - 55	shale siltstone
55 - 60	sandstone poorly cemented no cuttings light grey
60 - 80	as above harder from 76' salt & pepper light grey
80 - 88	as above taking water
88 - 95	shale with thin sandstone beds dark brown
95 - 100	shale dark brown
	air test 6 gpm
100 - 116	shale
116 - 122	shale with thin clayey sandstone lenses
122 - 132	sandstone? with shale layers
132 - 140	shale
140 - 160	shale, Lea Park

E-logged - gamma ray: P.R.
Sealed hole with BenSeal
Move rig ahead 10 ft. to install well (Hole #2489E)
case to 55' cemented casing
drill out to 68 ' install 5" stainless steel well screen with washdown bottom. Jet screen into 12 - 20 seive frac sand.
S.W.L. after developing open hole and letting recover for 3/4 hour.
10.4 m from ground surface.

GEOPHYSICAL LOG

RESPONSE PLACE
9820 - 106 ST
EDMONTON, ALBERTA
T5K 2J6

Alberta
ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

- [x] POINT RESISTANCE
- [ ] SPONTANEOUS POTENTIAL
- [ ] NORMAL RESISTIVITY
- [x] GAMMA
- [ ] CASING COLLAR LOCATOR
- [ ] TEMPERATURE GRADIENT
- [ ] DELTA TEMPERATURE
- [ ] MUD CELL
- [ ]
- [ ]

LOCATION | WELL | PROJECT

PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE No. 5
LOCATION LSD 15-27-55-12W4M

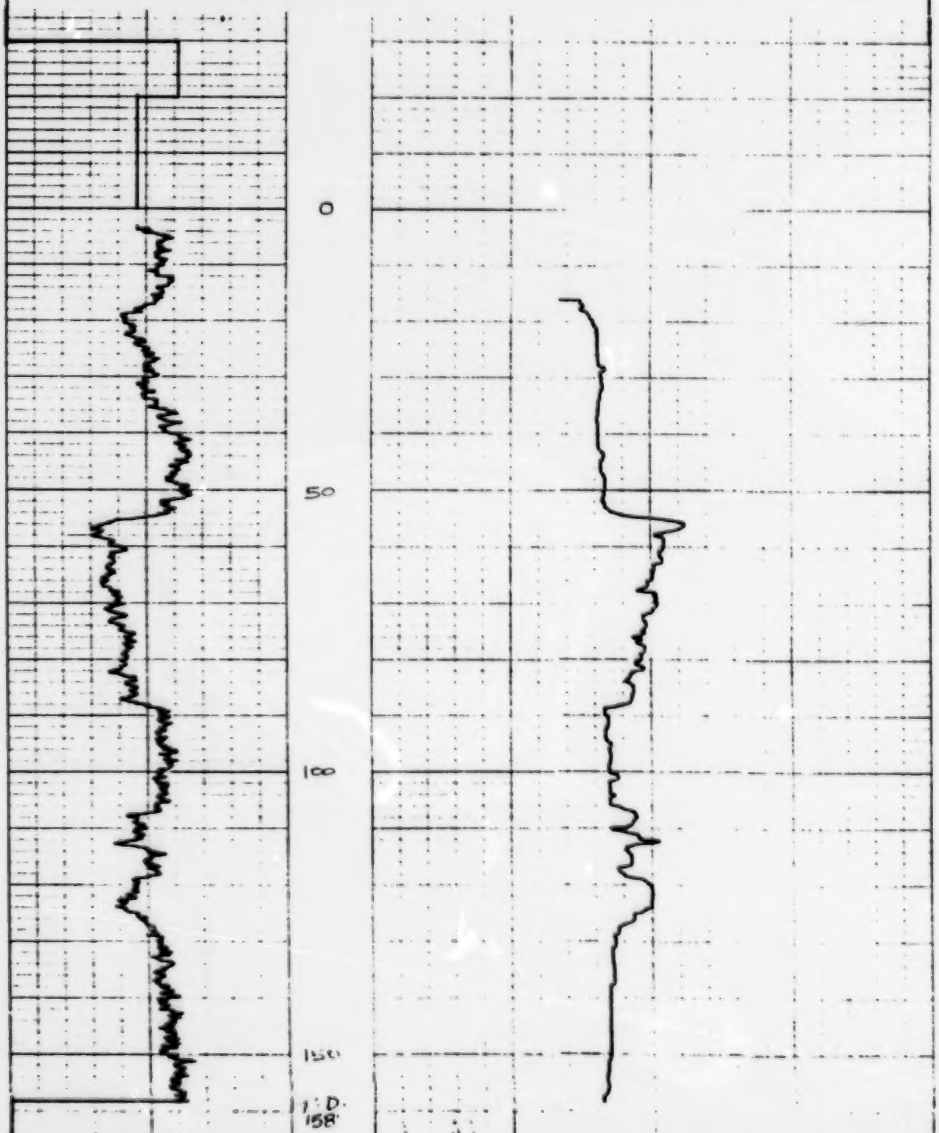
NTS MAP REFERENCE 73E/13
G.L. ELEVATION 1906'

	Gamma Run No 1	Point Res. Run No 1	MUD	Run No 1	Run No 2
Date	1988.05.03	1988.05.03	Nature	Natural/Hole gel	
First Reading	158'	158'	Density		
Last Reading	4'	0'	Viscosity		
Feet Logged	154'	158'	Resistivity		
T.D. (Driller)	160'	160'	Circ. Temp		
Bit Size	5 7/8"	5 7/8	pH		
Casing Size					
Interval					
Bit Size					
Casing Size					
Interval					
			Logged by	S. Clare	
			Witnessed by	M Cherniwchan	

REMARKS No S.P log - hole had been compressor tested to determine yield from sandstone from 100 ft, then air drilled to bottom.

GAMMA-RAY
Time Constant 3 sec.
Logging Speed 12'/min
Calibration 6 / A.27

POINT RESISTANCE
Logging Speed 60'/min
3 ± 50



ALBERTA ENVIRONMENT HOLE #2490E
(DUVERNAY #6)
LSD 1-22-55-12W4M

ELEV. 1915' amsl.

DEPTH (feet)	LITHOLOGY
0 - 9	sand fine gravel 8' yellow/orange color
9 - 22	sand
casing set to 22 feet	
22 - 24	sand
24 - 48	siltstone, very silty, almost a sandstone, brown
48 - 87	shale silty dark grey
87 - 107	sandstone poorly cemented light grey
107 - 120	shale silty some cuttings - silty sandstone dark brown

blew hole however it blew out from lots of fine sand then broke the casing seal. Pull stem out. Poured 2 bags Benseal down the outside of the casing to make a casing seal.

120 - 136	shale silty dark brown
136 - 159	sandstone
159 - 160	shale

Hole electric logged and gamma ray logged and sealed with Benseal.

GEOPHYSICAL LOG

Alberta
ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH

PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE No 6
LOCATION LSD 1-22-55-13 W4M

SITE MAP REFERENCE 73E/13
EL ELEVATION 1915'

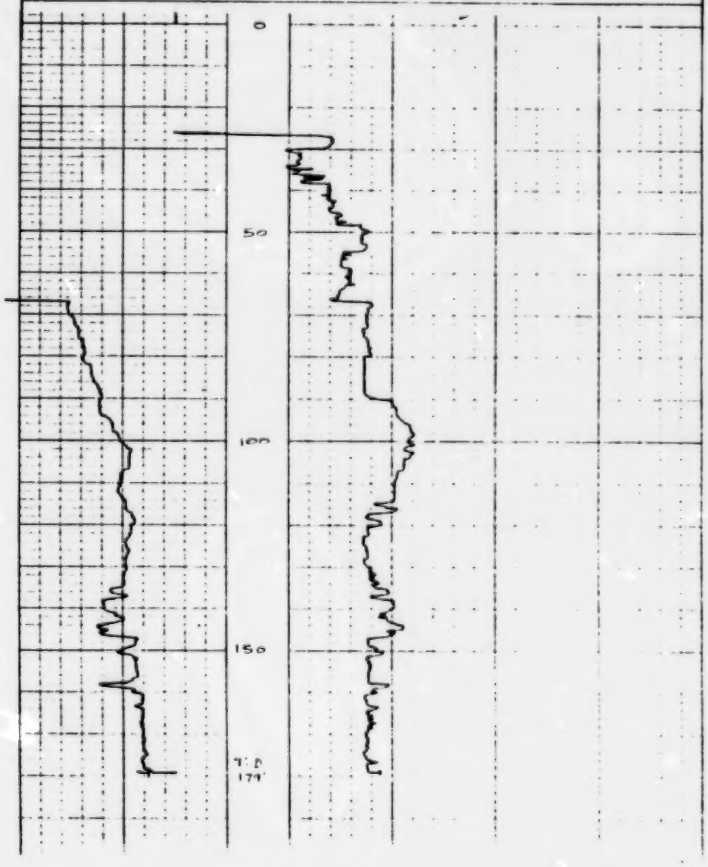
Date	1988.05.05
Depth Reading	179'
Logger Reading	21'
Depth Logged	153'
T.D. (Driller)	180'
Bit Size	6¾"
Casing Size	3½"
Interval	0-25'
Bit Size	5.78"
Casing Size	open
Interval	27-180'

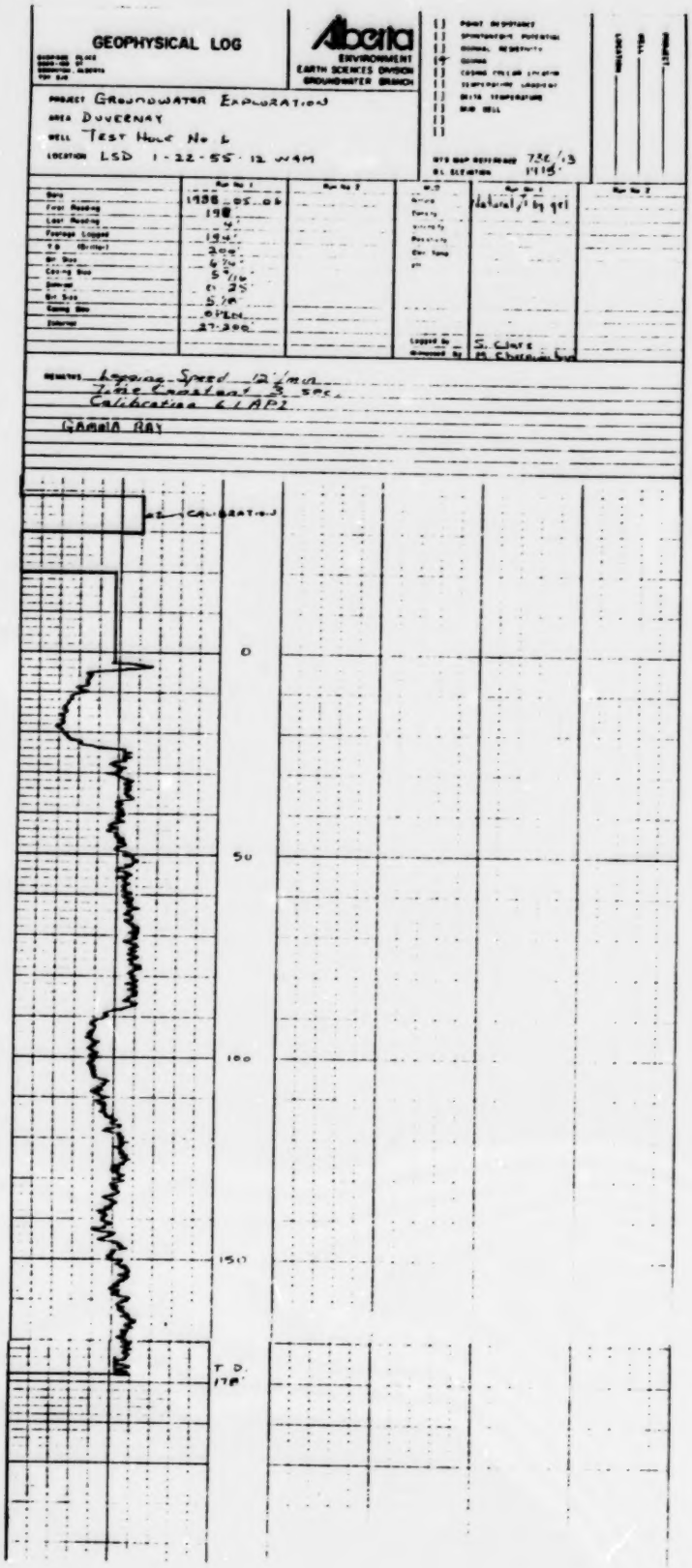
Logged by S. Clark
Witnessed by M. Cherrington

Remarks Note: Hole was compressor tested from 120' to determine the yield from a sandstone when drilled with water to 180'. S.P. has deflected off scale due to the air test.

S. P
20 mV/cm

R
5 Ω/cm




GEOPHYSICAL LOG
Alberta
ENVIRONMENT
EARTH SCIENCES DIVISION
GROUNDWATER BRANCH
PROJECT GROUNDWATER EXPLORATION
AREA DUVERNAY
WELL TEST HOLE No 6
LOCATION LSD 1-22-55-12 W4M
Date 1988-05-06
First Reading 198'
Last Reading 4'
Feet Logged 194'
T.D. (Driller) 200'
Bit Size 6 3/4"
Casing Size 5 1/2"
Bit Size 5 1/4"
Casing Size OPEN
Interval 27-200'
Logged By S. CLINE
Witnessed By M. Chorney
Logging Speed 12'/min
Time Constant 3 sec.
Calibration 6 API
GAMMA RAY
CALIBRATION
0
50
100
150
T.D. 178'

APPENDIX B

AQUIFER TEST

SITE 5

Alberta ENVIRONMENT

Earth Sciences Division
Groundwater Branch

Aquifer Test Data

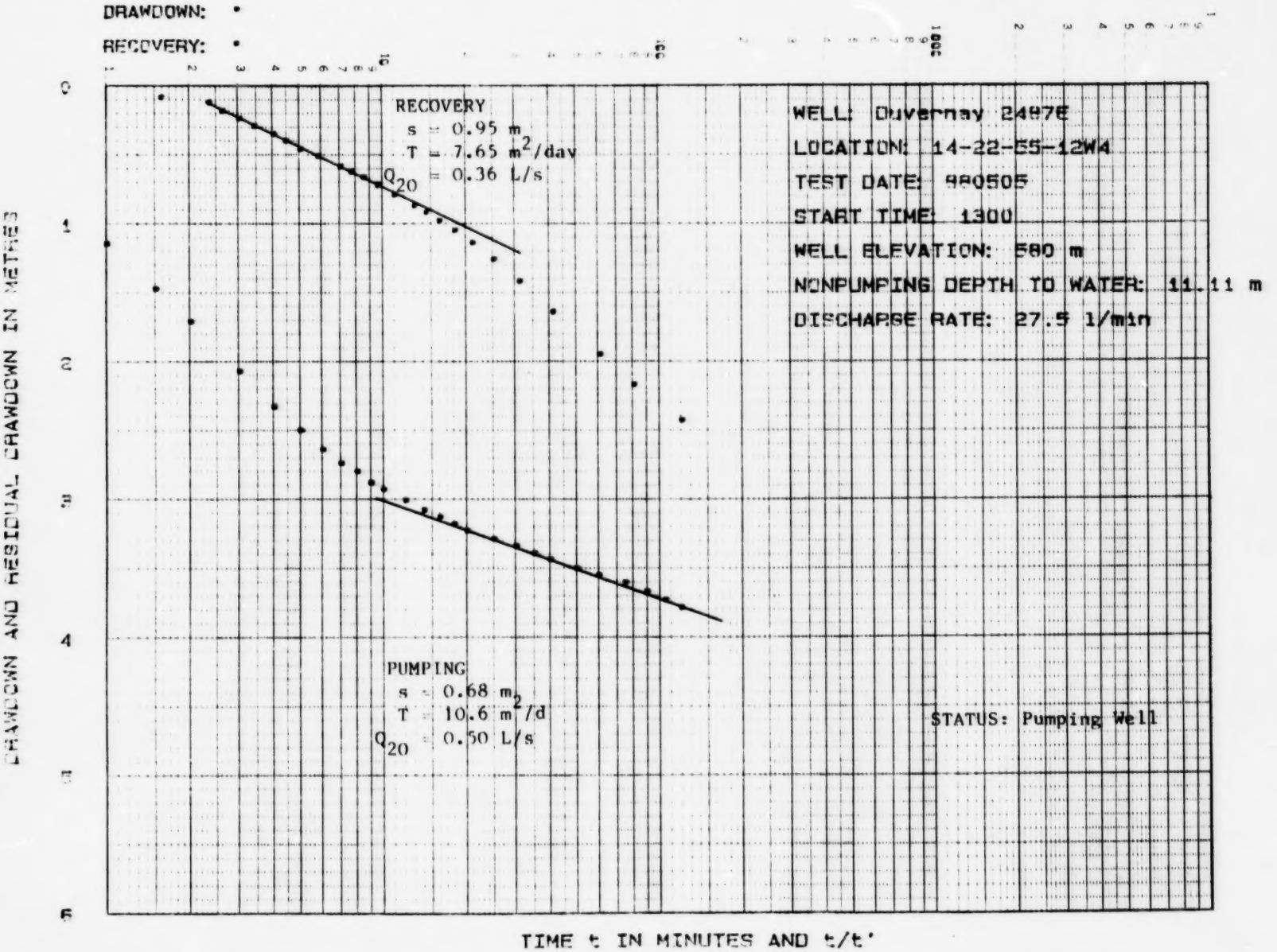
Well No. 2487E Well Owner: Alberta Environment Measured by: S. Clare/M. Cherniwchan

Location of project Duvernay Well location: Lsd. or ¼ 14 Sec. 22 Tp. 55 R. 12 Mer. W. 4

Status Pumping Well (pumping or observation well) R = -- (distance from pumping well in feet and direction) Date May 5, 1988 Page 1

Date	Time hrs. & mins.	Elapsed time in mins. t	Time since pumping stopped t'	t/t'	Depth to water ( )	Drawdown ( )	Pumping rate m^3 /d		REMARKS (i.e. water temp., static level, weather condition, well completion, etc.)
May 5/88	1:00 p.m.	0			11.11	0			static level
		0.5			11.81	0.70	39.7		6.06 Igpm
		1.0			12.26	1.15			weather - windy 15°C
		1.5			12.59	1.48			
		2			12.83	1.72			
		3			13.19	2.08			
		4			13.45	2.34			
		5			13.62	2.51			
		6			13.76	2.65			
		7			13.86	2.75			
		8			13.92	2.81			
		9			14.00	2.89			
		10			14.05	2.94	39.7		6.06 Igpm
		12			14.13	3.02			
		14			14.20	3.09			conductivity 960 umhos
		16			14.25	3.14	39.7		9 sec per gallon
		18			14.30	3.19			
		20			14.35	3.24			
		25			14.41	3.30	39.7		6.06 Igpm
		30			14.46	3.35			
		35			14.515	3.405			
		40			14.56	3.45			water temperature 6.4°C
		50			14.625	3.515			water sample taken
	2:00 p.m.	60			14.67	3.56	39.7		6.06 Igpm
		75			14.725	3.615			
		90			14.79	3.68	39.7		6.06 Igpm
		105			14.85	3.74			conductivity 950 umhos
	3:00 p.m.	120			14.905	3.795			
		120.5	0.5	241	14.00	2.89	0		
		121	1	121	13.55	2.44			
		121.5	1.5	81	13.29	2.18			
		122	2	61	13.07	1.96			
		123	3	41	12.76	1.65			
		124	4	31	12.54	1.43			
		125	5	25	12.38	1.27			
		126	6	21	12.26	1.15			
		127	7	18.1	12.17	1.06			
		128	8	16	12.10	0.99			
		129	9	14.3	12.04	0.93			
		130	10	13	11.99	0.88			
		132	12	11	11.91	0.80			
		134	14	9.57	11.84	0.73			
		136	16	8.5	11.785	0.675			
		138	18	7.67	11.745	0.635			
		140	20	7	11.705	0.595			
		145	25	5.8	11.63	0.52			
		150	30	5	11.58	0.47			
		155	35	4.4	11.52	0.41			
		160	40	4	11.47	0.36			
		170	50	3.4	11.41	0.30			
	4:00 p.m.	180	60	3	11.355	0.245			pulled pump
		195	75	2.6	11.30	0.19			
		210	90	2.3	11.24	0.13			
	5:30 p.m.	330	210	1.57	11.20	0.09			

AQUIFER TEST



APPENDIX C

CHEMICAL WATER ANALYSIS REPORT

FORM E S (LAB) 1

Alberta ENVIRONMENT

ENVIRONMENTAL PROTECTION SERVICES
EARTH SCIENCES DIVISION LABORATORY
BAG 3014
COUSINS BUILDING, LETHBRIDGE, ALBERTA
T1J 4B3 PHONE: 329-5322

DASH

Lab. No. 218
Date Rec'd May 4/88
Project Code No. 03

CHEMICAL WATER ANALYSIS REQUEST

PLEASE PRINT FIRMLY

This analysis will contribute to a resource data bank and be available to the public.

Client: DUVERNAY - 1 (NAME) (STREET) (CITY, TOWN, VILLAGE)

(POSTAL CODE) (TELEPHONE)

Source of Sample: WELL (STREAM, DUGOUT, WELL, TAP, ETC.)

If Well, Depth ..... meters, 140 feet, Depth to Water Level ..... meters, ... feet

Well Completion ..... (DRILLED, DUG, SCREEN, SETTLING ETC.)

Location 16 ¼ Section 22 Township 55 Range 10 W 4 Meridian

Submitted by (if not client): D. HULULAK Phone .....

14 th FLOOR STANDARD LIFE CENTRE 10405 JASPER AVE (ADDRESS) EDMONTON ALTA. (POSTAL CODE)

Results to: STEVE CLARE 14th FLOOR STANDARD LIFE CENTRE 10405 JASPER AVE EDMONTON ALTA.

Date of Sample: 27/04/88 Sampler's Comments .....

Reason for Sample:
- HUMAN CONSUMPTION ☐ For Interpretation Contact Local Health Unit
- LIVESTOCK CONSUMPTION ☐ For Interpretation Contact Local Veterinarian
- IRRIGATION ☐ For Interpretation Contact Irrigation Specialist

CHEMICAL WATER ANALYSIS REPORT

Analysis Date Completed May 6/88

EC 1.55 deci Siemens/m

pH 8.40

SAR 20.8

	Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)			Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)	
Calcium	15	N.E.*	Ca	Iron	1.89	0.3	Fe
Magnesium	5	N.E.	Mg	Fluoride	0.71	1.5	F
Hardness, Total	58	N.E.	$CaCO_3$	Sulphate	143	500	SO_4
Sodium	363	N.E.	Na	Chloride	37	250	Cl
Potassium	5	N.E.	K	Nitrate-Nitrogen Plus Nitrite-Nitrogen	<0.07	100	N
Carbonate	23	N.E.	CO_3				
Bicarbonate	762	N.E.	HCO_3	Ammonium-Nitrogen	1.79	1.0	N
Alkalinity, Total (T. Alk.)	663	N.E.	$CaCO_3$				
							N
				Total Dissolved Solids (TDS)	968	500	

Laboratory Comments:

*NE—Not Established

C. S. FOR
H. F. REGIER
BRANCH HEAD

WHITE - Client; YELLOW - File; BLUE - Hydrogeology Branch; PINK - Municipal Engineering

FORM E.S (LAB) 1

Alberta ENVIRONMENT

ENVIRONMENTAL PROTECTION SERVICES
EARTH SCIENCES DIVISION LABORATORY
BAG 3014
COUSINS BUILDING, LETHBRIDGE, ALBERTA
T1J 4B3 PHONE: 329-5322

RMS/GC

Lab. No. 219
Date Rec'd May 4/88
Project Code No. 03

CHEMICAL WATER ANALYSIS REQUEST

PLEASE PRINT FIRMLY

This analysis will contribute to a resource data bank and be available to the public.

Client: DIVERNAY - 4
(NAME) (STREET) (CITY, TOWN, VILLAGE)

(POSTAL CODE) (TELEPHONE)

Source of Sample: WELL
(STREAM, DUGOUT, WELL, TAP, ETC.)

If Well, Depth ..... meters, 102 feet, Depth to Water Level ..... meters, ... feet

Well Completion ..... (DRILLED, DUG, SCREEN, SETTLING ETC.)

Location 14 ¼ Section 22 Township 55 Range 12 W 4 Meridian

Submitted by (if not client): D. HUCULAK Phone .....

(ADDRESS) (POSTAL CODE)

Results to: STEVE CLARK 19th FLOOR STANDARD LIFE CENTRE 10405 JASPER AVE EDMONTON ALTA.

Date of Sample: April 29/88 Sampler's Comments .....

Reason for Sample:
- HUMAN CONSUMPTION ☐ For Interpretation Contact Local Health Unit
- LIVESTOCK CONSUMPTION ☐ For Interpretation Contact Local Veterinarian
- IRRIGATION ☐ For Interpretation Contact Irrigation Specialist

CHEMICAL WATER ANALYSIS REPORT

Analysis
Date Completed May 6/88
pH 8.40
EC 1.51 deci Siemens/m
SAR 32.6

	Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)	
Calcium	7	N.E.*	Ca
Magnesium	1	N.E.	Mg
Hardness, Total	24	N.E.	$CaCO_3$
Sodium	363	N.E.	Na
Potassium	3	N.E.	K
Carbonate	19	N.E.	CO_3
Bicarbonate	708	N.E.	HCO_3
Alkalinity, Total (T. Alk.)	612	N.E.	$CaCO_3$

	Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)	
Iron	<0.01	0.3	Fe
Fluoride	0.40	1.5	F
Sulphate	168	500	SO_4
Chloride	33	250	Cl
Nitrate-Nitrogen Plus Nitrite-Nitrogen	<0.07	10.0	N
Ammonium-Nitrogen	1.01	1.0	N
			N
Total Dissolved Solids (TDS)	943	500	

Laboratory Comments:

*NE—Not Established.

E.S. FOR
H. F. REGIER
BRANCH HEAD

WHITE – Client; YELLOW – File; BLUE – Hydrogeology Branch; PINK – Municipal Engineering

FORM E S (LAB) 1

Alberta ENVIRONMENT

ENVIRONMENTAL PROTECTION SERVICES
EARTH SCIENCES DIVISION LABORATORY
BAG 3014
COUSINS BUILDING, LETHBRIDGE, ALBERTA
T1J 4B3 PHONE 329-5322

CHEMICAL WATER ANALYSIS REQUEST

Lab. No. 238
Date Rec'd May 11/88
Project Code No. 03

PLEASE PRINT FIRMLY

DUVERAY # 4-1

This analysis will contribute to a resource data bank and be available to the public.

Client: Stephen Clark Technical Services
(NAME) (STREET) (CITY, TOWN, VILLAGE)
Hydrogeology Br. 14th Fl. Standard Life Edmonton
(POSTAL CODE) (TELEPHONE)
Source of Sample: Test well not screened 427-6189
(STREAM, DUGOUT, WELL, TAP, ETC.)

If Well, Depth 1' meters, feet. Depth to Water Level meters, feet
Well Completion cased off surficial - air lift test on S.S.
(DRILLED, DUG, SCREEN, SETTLING ETC.)
Location 14 ¼ Section 22 Township 55 Range 12 W 4 Meridian

Submitted by (if not client): Phone
(ADDRESS) (POSTAL CODE)
Results to: Stephen Clark
Date of Sample: May 3/88 Sampler's Comments Sample taken after well screened over weekend.

Reason for Sample:
- HUMAN CONSUMPTION ☐ For Interpretation Contact Local Health Unit
- LIVESTOCK CONSUMPTION ☐ For Interpretation Contact Local Veterinarian
- IRRIGATION ☐ For Interpretation Contact Irrigation Specialist

CHEMICAL WATER ANALYSIS REPORT

Analysis
Date Completed May 12/88
pH 8.07
EC 1.45 deci Siemens/m
SAR 26.2

	Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)	
Calcium	10	N.E.*	Ca
Magnesium	2	N.E.	Mg
Hardness, Total	32	N.E.	$CaCO_3$
Sodium	338	N.E.	Na
Potassium	3	N.E.	K
Carbonate	<	N.E.	CO_3
Bicarbonate	659	N.E.	HCO_3
Alkalinity, Total (T. Alk.)	540	N.E.	$CaCO_3$

	Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)	
Iron	0.40	0.3	Fe
Fluoride	0.10	1.5	F
Sulphate	181	500	SO_4
Chloride	21	250	Cl
Nitrate-Nitrogen Plus Nitrite-Nitrogen	<0.07	10.0	N
Ammonium-Nitrogen	1.4	1.0	N
			N
Total Dissolved Solids (TDS)	859	500	

Laboratory Comments:

*NE—Not Established.

H. F. REGIER
BRANCH HEAD
FOR

WHITE - Client; YELLOW - File; BLUE - Hydrogeology Branch; PINK - Municipal Engineering

FORM E S (LAB) 1

Alberta ENVIRONMENT

ENVIRONMENTAL PROTECTION SERVICES
EARTH SCIENCES DIVISION LABORATORY
BAG 3014
COUSINS BUILDING, LETHBRIDGE, ALBERTA
T1J 4B3 PHONE 329-5322

CHEMICAL WATER ANALYSIS REQUEST

Lab. No. 238
Date Rec'd May 11/88
Project Code No. 03

PLEASE PRINT FIRMLY

This analysis will contribute to a resource data bank and be available to the public.

Client: DOWLING #5 c/o Stephen Clare
(NAME) Alberta Environment, Technical Services (STREET)
Hydrogeology Br. 14th Fl. Standard Life (CITY, TOWN, VILLAGE)
(POSTAL CODE) (TELEPHONE) 427-6181

Source of Sample: Observation Well
(STREAM, DUGOUT, WELL, TAP, ETC.)

If Well, Depth 28 meters, 86 feet. Depth to Water Level 10 meters, 32 feet

Well Completion drilled, cement grout, 7 slot screen (5') sandpacked
(DRILLED, DUG, SCREEN, SETTLING ETC.)

Location 15 ¼ Section 22 Township 55 Range 12 W 4 Meridian

Submitted by (if not client): Phone
(ADDRESS) (POSTAL CODE)

Results to: Stephen Clare

Date of Sample: May 5/88 Sampler's Comments

Reason for Sample:
- HUMAN CONSUMPTION ☐ For Interpretation Contact Local Health Unit
- LIVESTOCK CONSUMPTION ☐ For Interpretation Contact Local Veterinarian
- IRRIGATION ☐ For Interpretation Contact Irrigation Specialist

CHEMICAL WATER ANALYSIS REPORT

Analysis
Date Completed May 12/88 EC 1.54 deci Siemens/m
pH 8.96 SAR 23.9

	Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)			Sample Results mg/L (ppm)	Canadian Drinking Water Standards mg/L (ppm)	
Calcium	12	N.E.*	Ca	Iron	0.31	0.3	Fe
Magnesium	3	N.E.	Mg	Fluoride	0.47	1.5	F
Hardness, Total	43	N.E.	$CaCO_3$	Sulphate	42.1	500	SO_4
Sodium	359	N.E.	Na	Chloride	37	250	Cl
Potassium	4	N.E.	K	Nitrate-Nitrogen Plus Nitrite-Nitrogen	0.07	10.0	N
Carbonate	20	N.E.	CO_3	Ammonium-Nitrogen	1.75	1.0	N
Bicarbonate	722	N.E.	HCO_3				N
Alkalinity, Total (T. Alk.)	625	N.E.	$CaCO_3$				
				Total Dissolved Solids (TDS)	949	500	

Laboratory Comments:

*NE—Not Established.

FOR
H. F. REGIER
BRANCH HEAD

WHITE - Client; YELLOW - File; BLUE - Hydrogeology Branch; PINK - Municipal Engineering

APPENDIX D

WATER WELL DRILLERS REPORTS

WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO: DIRECTOR OF EARTH SCIENCES ALBERTA ENVIRONMENT

① CONTRACTOR
NAME: Alta. Environment
ADDRESS: 10405 - Jasper Ave.
Edmonton, Alta

⑧ WELL OWNER
NAME: Alta Env (L.H. Butcher)
ADDRESS: Diversion, Alta
2484-E

⑫ LOCATION

1/4	SEC.	TWP.	RGE.	WEST OF MERIDIAN
LSD 16	22	55	12	W4

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

LICENCE NO: 524
DATE STARTED: Apr 27 19 88
DATE COMPLETED: Apr 27 19 88

⑩ ILLUSTRATION OF WELL CONSTRUCTION

Test hole

Test hole approx. 50' S & E-W tree line - approx. 5' W & N-S fence line

Test hole abandoned with Bentonite.

⑭ TYPE OF WELL: ROTARY ☑ BORED ☐ CABLE TOOL ☐ JET ☐ DUG ☐ OTHER ☐

⑮ TYPE OF WORK: NEW WELL ☐ DEEPEN ☐ TEST HOLE ☑ RECONDITION ☐ ABANDON ☐

⑯ PROPOSED USE: DOMESTIC ☐ STOCK ☐ IRRIGATION ☐ MUNICIPAL ☐ INDUSTRIAL ☐ OBSERVATION ☐

⑰ PRODUCTION TEST (PUMPING AT A CONSTANT RATE)

TIME	WATER LEVEL WHILE PUMPING FT/M	WATER LEVEL RECOVERY FT/M
0		
30 SEC.		
1 MIN.		
1 MIN. 30 SEC.		
2 MIN.		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
18		
20		
25		
30		
35		
40		
50		
60		
75		
90		
105		
120		

PUMP ☐ BAILER ☐ AIR ☑

NON-PUMPING WATER LEVEL: FT/M
RATE OF YIELD: 3-4 I.G.P.M. L.P.M.
DURATION OF TEST (MIN. 2 HR TEST): ½ HRS. MINS.
PUMPING WATER LEVEL OR BAILING LEVEL: 180 (est)
TOTAL DRAWDOWN AT END OF TEST: FT/M
PUMP SET AT: FT/M
RECOMMENDED PUMPING RATE: I.G.P.M./L.P.M.
ADDITIONAL PRODUCTION TEST INFO: YES/NO

⑱ WATER QUALITY
CHEMICAL ANALYSIS: YES ☐ NO ☑
BACTERIAL ANALYSIS: YES ☑ NO ☐
WATER TEMPERATURE:
OTHER:

WELL COMPLETION DATA

② DESIGN:
OPEN HOLE ☐ SLOTTED CASING ☐
SCREEN ☐ GRAVEL PACK ☐
DIAMETER OF HOLE:
BOTTOMED IN: CLAY ☐ SAND ☐
SANDSTONE ☐ SHALE ☐ COAL ☐
DEPTH TO TOP OF BEDROCK:
TOTAL DEPTH:

③ CASING:
TYPE:
SIZE O.D. WALL THICKNESS:
BOTTOM SET AT: FT/M

④ SEAL: YES ☐ NO ☐
DEPTH OF SEAL: FT/M
DESCRIPTION:

⑤ LINER: YES ☐ NO ☐
TYPE:
SIZE O.D.:
WALL THICKNESS:
BOTTOM AT: FT/M TOP AT: FT/M
PERFORATED FROM: FT/M TO: FT/M
HOW PERFORATED: TORCH ☐ MACHINE ☐ OTHER ☐
SIZE PERFORATIONS: IN/MM BY IN/MM

⑥ SAND PACK: YES ☐ NO ☐
SIZE: AMOUNT:

⑦ SCREEN: YES ☐ NO ☐
MATERIAL:
SIZE I.D. (CLEAR):
LENGTH:
SLOT SIZE:
FT/M FT/M
FITTINGS TOP:
FITTINGS BOTTOM:
METHOD OF INSTALLATION:

⑨ PUMP: YES ☐ NO ☐
TYPE: H.P.:
SIZE: VOLTAGE:
DROP PIPE SIZE: LENGTH:
MATERIAL:
INTAKE AT: FT/M

⑪ FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	
GROUND LEVEL	2	topsoil
2	8	sd
8	30	sdy gr cl
30	71	sh
71	75	ss
75	78	hard ss ledge
78	98	ss
98	118	ss/sh stringers
118	121	ss
121	134	ss
134	141	ss
141	145	ss
145	178	ss
		Test hole compressor tested from 100' - yielded approx. 3-4 igpm

⑫ ELECTRIC LOG: YES ☑ NO ☐
GAMMA LOG: YES ☑ NO ☐

CERTIFICATION
WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER.

SIGNATURE: [signature]
JOURNEYMAN NO.: VA7321 DATE: April 27 19 88

WELL OWNER

ANTICIPATED WATER REQUIREMENT:
_____ GALLONS/LITRES PER DAY
I HAVE RECEIVED A COPY OF THIS REPORT.
SIGNATURE: _____
DATE: _____ 19 _____

ALBERTA ENVIRONMENT COPY

WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO: DIRECTOR OF EARTH SCIENCES ALBERTA ENVIRONMENT

① CONTRACTOR

NAME: Alta. Environment
ADDRESS: 10405 Jasper Ave. Edmonton, Alta

LICENCE NO: 524
DATE STARTED: April 27 19 88
DATE COMPLETED: April 28 19 88

⑨ WELL OWNER

NAME: Alta Env. (Bank of B.C.)
ADDRESS: Duvernay, Alta 2485-E

⑬ LOCATION

1/4	SEC	TWP.	RGE.	WEST OF MERIDIAN
9	27	55	12	4

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

WELL COMPLETION DATA

② DESIGN:
OPEN HOLE ☐ SLOTTED CASING ☐
SCREEN ☐ GRAVEL PACK ☐
DIAMETER OF HOLE
BOTTOMED IN: CLAY ☐ SAND ☐
SANDSTONE ☐ SHALE ☐ COAL ☐
DEPTH TO TOP OF BEDROCK
TOTAL DEPTH

③ CASING:
TYPE
SIZE O.D. WALL THICKNESS
BOTTOM SET AT FT/M

④ SEAL: YES ☐ NO ☐
DEPTH OF SEAL FT/M
DESCRIPTION

⑤ LINER: YES ☐ NO ☐
TYPE
SIZE O.D.
WALL THICKNESS
BOTTOM AT FT/M TOP AT FT/M
PERFORATED FROM FT/M TO FT/M
HOW PERFORATED: TORCH ☐ MACHINE ☐ OTHER ☐
SIZE PERFORATIONS IN/MM BY IN/MM

⑥ SAND PACK: YES ☐ NO ☐
SIZE AMOUNT

⑦ SCREEN: YES ☐ NO ☐
MATERIAL
SIZE I.D. (CLEAR)
LENGTH
SLOT SIZE
FT/M FT/M
FITTINGS TOP
FITTINGS BOTTOM
METHOD OF INSTALLATION

⑧ PUMP: YES ☐ NO ☐
TYPE H.P.
SIZE VOLTAGE
DROP PIPE SIZE LENGTH
MATERIAL
INTAKE AT FT/M

⑩ ILLUSTRATION OF WELL CONSTRUCTION

Test hole

Test hole approx. 40' W of Highway 76 + approx. 100' N of approach into field.

Test hole abandoned with Bengal

⑪ FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	FORMATION LOG DESCRIPTION
GROUND LEVEL	2	topsoil
2	12	weathered ss
12	19	gr ss / interbedded sh
19	44	sh
44	47	ss
47	53	sh
53	59	sh / ss Viking
59	61	sh
61	70	ss
70	99	sh
		Compressor test hel pm 80
		Hole prod. approx. 1 USgpm

⑫ ELECTRIC LOG: YES ☑ NO ☐
GAMMA LOG: YES ☑ NO ☐

⑭ TYPE OF WELL:

ROTARY ☑ BORED ☐ CABLE TOOL ☐
JET ☐ DUG ☐ OTHER ☐

⑮ TYPE OF WORK:

NEW WELL ☐ DEEPEN ☐ TEST HOLE ☑
RECONDITION ☐ ABANDON ☐

⑯ PROPOSED USE:

DOMESTIC ☐ STOCK ☐ IRRIGATION ☐
MUNICIPAL ☐ INDUSTRIAL ☐ OBSERVATION ☐

⑰ PRODUCTION TEST

PUMPING AT A CONSTANT RATE

TIME	WATER LEVEL WHILE PUMPING FT/M	WATER LEVEL RECOVERY FT/M
0		
30 SEC		
1 MIN		
1 MIN. 30 SEC		
2 MIN		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
18		
20		
25		
30		
35		
40		
50		
60		
75		
90		
105		
120		

PUMP ☐ BAILER ☐ AIR ☐
NON-PUMPING WATER LEVEL FT/M
RATE OF YIELD I.G.P.M. /L.P.M.
DURATION OF TEST (MIN. 2 HR TEST) HRS. MINS.
PUMPING WATER LEVEL OR BAILING LEVEL FT/M
TOTAL DRAWDOWN AT END OF TEST FT/M
PUMP SET AT FT/M
RECOMMENDED PUMPING RATE I.G.P.M. /L.P.M.
ADDITIONAL PRODUCTION TEST INFO. YES/NO

⑱ WATER QUALITY:

CHEMICAL ANALYSIS: YES ☐ NO ☐
BACTERIAL ANALYSIS: YES ☐ NO ☐
WATER TEMPERATURE
OTHER

CERTIFICATION
WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER.

SIGNATURE
JOURNEYMAN NO. VA 3321 DATE April 29 19 88

WELL OWNER

ANTICIPATED WATER REQUIREMENT:
_____ GALLONS/LITRES PER DAY
I HAVE RECEIVED A COPY OF THIS REPORT.
SIGNATURE
DATE 19

WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO: DIRECTOR OF EARTH SCIENCES ALBERTA ENVIRONMENT

① CONTRACTOR

NAME: Alta. Environment
ADDRESS: 10405 - Jasper Ave.
Edmonton Alta

⑨ WELL OWNER

NAME: Alta. Env. (Western Resources Ltd.)
ADDRESS: Duvernay, Alta
2486-E

⑫ LOCATION

1/4	SEC.	TWP.	RGE.	WEST OF MERIDIAN
5	26	55	12	W4

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

LICENCE NO: 524
DATE STARTED: April 28 19 88
DATE COMPLETED: April 28 19 88

⑩ ILLUSTRATION OF WELL CONSTRUCTION

Test hole

Test hole approx 200m E of Highway 76 - approx. 660 m N of Highway 639

Test hole abandoned with Bentonite

⑭ TYPE OF WELL:

ROTARY ☑ BORED ☐ CABLE-TOOL ☐
JET ☐ DUG ☐ OTHER ☐

⑮ TYPE OF WORK:

NEW WELL ☐ DEEPEN ☐ TEST HOLE ☑
RECONDITION ☐ ABANDON ☐

⑯ PROPOSED USE:

DOMESTIC ☐ STOCK ☐ IRRIGATION ☐
MUNICIPAL ☐ INDUSTRIAL ☐ OBSERVATION ☐

WELL COMPLETION DATA

② DESIGN:
OPEN HOLE: SLOTTED CASING:
SCREEN: GRAVEL PACK:
DIAMETER OF HOLE:
BOTTOMED IN: CLAY: SAND:
SANDSTONE: SHALE: COAL:
DEPTH TO TOP OF BEDROCK:
TOTAL DEPTH:

③ CASING:
TYPE:
SIZE O.D.: WALL THICKNESS:
BOTTOM SET AT: FT/M

④ SEAL: YES ☐ NO ☐
DEPTH OF SEAL: FT/M
DESCRIPTION:

⑤ LINER: YES ☐ NO ☐
TYPE:
SIZE O.D.:
WALL THICKNESS:
BOTTOM AT: FT/M TOP AT: FT/M
PERFORATED FROM: FT/M TO: FT/M
HOW PERFORATED: TORCH ☐
MACHINE ☐ OTHER ☐
SIZE PERFORATIONS: IN/MM BY:

⑥ SAND PACK: YES ☐ NO ☐
SIZE: AMOUNT:

⑦ SCREEN: YES ☐ NO ☐
MATERIAL:
SIZE I.D. (CLEAR):
LENGTH:
SLOT SIZE:
FT/M FT/M
FITTINGS TOP:
FITTINGS BOTTOM:
METHOD OF INSTALLATION:

⑧ PUMP: YES ☐ NO ☐
TYPE: H.P.:
SIZE: VOLTAGE:
DROP PIPE SIZE: LENGTH:
MATERIAL:
INTAKE AT: FT/M

⑪ FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	
GROUND LEVEL	2	topsoil
2	4	sd
4	16	clay boulders
16	20	sh
20	39	ss
39	46	ss
46	59	sh
59	79	sh
79	84	ss
84	86	sh
86	93	ss
93	138	sh
138	143	hd ss layer
143	148	ss
148	179	sh
		Compressor tested hole
		Yield approx. 1/2gpm.

⑫ ELECTRIC LOG: YES ☑ NO ☐
GAMMA LOG: YES ☑ NO ☐

⑰ PRODUCTION TEST (PUMPING AT A CONSTANT RATE)

TIME	WATER LEVEL WHILE PUMPING FT/M	WATER LEVEL RECOVERY FT/M
0		
30 SEC.		
1 MIN.		
1 MIN. 30 SEC.		
2 MIN.		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
18		
20		
25		
30		
35		
40		
50		
60		
75		
90		
105		
120		

PUMP ☐ BAILER ☐ AIR ☐

NON-PUMPING WATER LEVEL: FT/M
RATE OF YIELD: I.G.P.M./L.P.M.
DURATION OF TEST (MIN. 2 HR. TEST): HRS. MINS.
PUMPING WATER LEVEL OR BAILING LEVEL: FT/M
TOTAL DRAWDOWN AT END OF TEST: FT/M
PUMP SET AT: FT/M
RECOMMENDED PUMPING RATE: I.G.P.M./L.P.M.
ADDITIONAL PRODUCTION TEST INFO.: YES/NO

⑱ WATER QUALITY:

CHEMICAL ANALYSIS: YES ☑ NO ☐
BACTERIAL ANALYSIS: YES ☐ NO ☐
WATER TEMPERATURE:
OTHER:

CERTIFICATION
WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER.

SIGNATURE: [signature]
JOURNEYMAN NO.: VA 3721 DATE: April 28 19 88

WELL OWNER

ANTICIPATED WATER REQUIREMENT:
_____ GALLONS/LITRES PER DAY
I HAVE RECEIVED A COPY OF THIS REPORT.
SIGNATURE: _____
DATE: _____ 19_____

ALBERTA ENVIRONMENT COPY

WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO: DIRECTOR OF EARTH SCIENCES ALBERTA ENVIRONMENT

① CONTRACTOR

NAME: Alta. Environment
ADDRESS: 10405 - Jasper Ave
Edmonton, Alta

LICENCE NO: 524
DATE STARTED: Apr. 29 19 88
DATE COMPLETED: Apr. 29 19 88

⑨ WELL OWNER

NAME: Alta. Env. (W. Hohol)
ADDRESS: Duvernay, Alta.
3487-E

⑩ LOCATION

1/4	SEC.	TWP.	RGE.	WEST OF MERIDIAN
14	22	55	12	4

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

WELL COMPLETION DATA

② DESIGN:
OPEN HOLE ☐ SLOTTED CASING ☐
SCREEN ☐ GRAVEL PACK ☐
DIAMETER OF HOLE:
BOTTOMED IN: CLAY ☐ SAND ☐
SANDSTONE ☐ SHALE ☐ COAL ☐
DEPTH TO TOP OF BEDROCK
TOTAL DEPTH

③ CASING:
TYPE
SIZE O.D. WALL THICKNESS
BOTTOM SET AT FT/M

④ SEAL: YES ☐ NO ☐
DEPTH OF SEAL FT/M
DESCRIPTION

⑤ LINER: YES ☐ NO ☐
TYPE
SIZE O.D.
WALL THICKNESS
BOTTOM AT FT/M TOP AT FT/M
PERFORATED FROM FT/M TO FT/M
HOW PERFORATED: TORCH ☐
MACHINE ☐ OTHER ☐
SIZE PERFORATIONS IN/MM BY SLOTS

⑥ SAND PACK: YES ☐ NO ☐
SIZE AMOUNT

⑦ SCREEN: YES ☐ NO ☐
MATERIAL
SIZE I.D. (CLEAR)
LENGTH
SLOT SIZE
FT/M FT/M
FITTINGS TOP
FITTINGS BOTTOM
METHOD OF INSTALLATION

⑧ PUMP: YES ☐ NO ☐
TYPE H.P.
SIZE VOLTAGE
DROP PIPE SIZE LENGTH
MATERIAL
INTAKE AT FT/M

⑭ ILLUSTRATION OF WELL CONSTRUCTION

Test hole

Test hole located approx. 270' W of N-S fence line & approx. 10' S of E-W fence line

Test hole abandoned with Benseal

⑪ FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	FORMATION LOG DESCRIPTION
GROUND LEVEL	1	topsoil
1	2	gvl layer - boulders
2	16	sdy brn cl
16	42	gy cl
42	65	sh
65	69	sh/ss stringers
69	87	ss (soft)
87	89	hd ss ledge
89	95	ss
95	99	silty ss
99	106	ss
106	109	sh

⑫ ELECTRIC LOG: YES ☐ NO ☑
GAMMA LOG: YES ☑ NO ☐

⑭ TYPE OF WELL:

ROTARY ☑ BORED ☐ CABLE TOOL ☐
JET ☐ DUG ☐ OTHER ☐

⑮ TYPE OF WORK:

NEW WELL ☐ DEEPEN ☐ TEST HOLE ☑
RECONDITION ☐ ABANDON ☐

⑯ PROPOSED USE:

DOMESTIC ☐ STOCK ☐ IRRIGATION ☐
MUNICIPAL ☐ INDUSTRIAL ☐ OBSERVATION ☐

⑰ PRODUCTION TEST (PUMPING AT A CONSTANT RATE)

TIME	WATER LEVEL WHILE PUMPING FT/M	WATER LEVEL RECOVERY FT/M
0		
30 SEC.		
1 MIN.		
1 MIN. 30 SEC.		
2 MIN.		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
18		
20		
25		
30		
35		
40		
50		
60		
75		
90		
100		
120		

PUMP ☐ BAILER ☐ AIR ☑
NON-PUMPING WATER LEVEL 94.92 FT/M
RATE OF YIELD 12 - 15 G.P.M. L.P.M.
DURATION OF TEST (MIN. 2 HR. TEST) 1 HRS. 30 MINS.
PUMPING WATER LEVEL OR BAILING LEVEL 105 FT/M
TOTAL DRAWDOWN AT END OF TEST FT/M
PUMP SET AT FT/M
RECOMMENDED PUMPING RATE 12 - 15 G.P.M. L.P.M.
ADDITIONAL PRODUCTION TEST INFO. YES/NO
Compressor turned off at 1 hr.

⑱ WATER QUALITY

CHEMICAL ANALYSIS YES ☑ NO ☐
BACTERIAL ANALYSIS YES ☐ NO ☐
WATER TEMPERATURE
OTHER

CERTIFICATION WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER.

SIGNATURE [signature]
JOURNEYMAN NO. VA 7721 DATE Apr. 29 19 88

WELL OWNER

ANTICIPATED WATER REQUIREMENT:
GALLONS/LITRES PER DAY
I HAVE RECEIVED A COPY OF THIS REPORT.
SIGNATURE
DATE 19

WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO: DIRECTOR OF EARTH SCIENCES ALBERTA ENVIRONMENT

① CONTRACTOR

NAME: Alta. Environment
ADDRESS: 10405 - Jasper Ave
Edmonton, Alta

LICENCE NO: 524
DATE STARTED: May 2 19 88
DATE COMPLETED: May 3 19 88

WELL COMPLETION DATA

② DESIGN:
OPEN HOLE ☐ SLOTTED CASING ☐
SCREEN ☐ GRAVEL PACK ☐
DIAMETER OF HOLE
BOTTOMED IN: CLAY ☐ SAND ☐
SANDSTONE ☐ SHALE ☐ COAL ☐
DEPTH TO TOP OF BEDROCK
TOTAL DEPTH

③ CASING:
TYPE
SIZE O.D. WALL THICKNESS
BOTTOM SET AT FT/M

④ SEAL: YES ☐ NO ☐
DEPTH OF SEAL FT/M
DESCRIPTION

⑤ LINER: YES ☐ NO ☐
TYPE
SIZE O.D.
WALL THICKNESS
BOTTOM AT FT/M TOP AT FT/M
PERFORATED FROM FT/M TO FT/M
HOW PERFORATED: TORCH ☐
MACHINE ☐ OTHER ☐
SIZE PERFORATIONS IN/MM BY IN/MM

⑥ SAND PACK: YES ☐ NO ☐
SIZE AMOUNT

⑦ SCREEN: YES ☐ NO ☐
MATERIAL
SIZE I.D. (CLEAR)
LENGTH
SLOT SIZE
FT/M FT/M
FITTINGS TOP
FITTINGS BOTTOM
METHOD OF INSTALLATION

⑧ PUMP: YES ☐ NO ☐
TYPE H.P.
SIZE VOLTAGE
DROP PIPE SIZE LENGTH
MATERIAL
SET/SET AT FT/M

⑨ WELL OWNER

NAME: Alta Env (Lit. Butcher)
ADDRESS: Peace River, Alta
2488-8

⑩ LOCATION

1/4	SEC.	TWP.	RGE.	MERIDIAN
15	22	55	12	W4

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

⑪ ILLUSTRATION OF WELL CONSTRUCTION

Test Hole

Compressor tested hole Ran
90'
Yield approx 5-6 IGPM
Test Hole approx. 240' S of E-W
fence line = approx. 20' W of N-S
fence line
Test hole abandoned with
Removal.

⑫ TYPE OF WELL:

ROTARY ☑ DUG ☐ CABLE TOOL ☐
JET ☐ BORED ☐ OTHER ☐

⑬ TYPE OF WORK:

NEW WELL ☐ DEEPEN ☐ TEST HOLE ☑
RECONDITION ☐ ABANDON ☐

⑭ PROPOSED USE:

DOMESTIC ☐ STOCK ☐ IRRIGATION ☐
MUNICIPAL ☐ INDUSTRIAL ☐ OBSERVATION ☐

⑮ PRODUCTION TEST (PUMPING AT A CONSTANT RATE)

TIME	WATER LEVEL WHILE PUMPING FT/M	WATER LEVEL RECOVERY FT/M
0		
30 SEC.		
1 MIN.		
1 MIN. 30 SEC.		
2 MIN.		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
18		
20		
25		
30		
35		
40		
50		
60		
75		
90		
105		
120		

PUMP ☐ BAILER ☐ AIR ☐
NON-PUMPING WATER LEVEL FT/M
RATE OF YIELD I.G.P.M./L.P.M.
DURATION OF TEST (MIN. 2 HR. TEST) HRS. MINS.
PUMPING WATER LEVEL OR BAILING LEVEL FT/M
TOTAL DRAWDOWN AT END OF TEST FT/M
PUMP SET AT FT/M
RECOMMENDED PUMPING RATE I.G.P.M./L.P.M.
ADDITIONAL PRODUCTION TEST INFO. YES/NO

⑯ WATER QUALITY:

CHEMICAL ANALYSIS YES ☐ NO ☐
BACTERIAL ANALYSIS YES ☐ NO ☐
WATER TEMPERATURE
OTHER

⑪ FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	FORMATION LOG DESCRIPTION
GROUND LEVEL	2	topsoil
2	3	Gvl
3	14	stky brn cl
14	19	stky grey cl
19	39	sd
39	55	sd
55	70	sd + gs
70	79	ss
79	90	ss
90	95	sd / silty ss
95	109	sd
109	126	sd
126	159	sd

only resistivity

⑫ ELECTRIC LOG YES ☑ NO ☐
GAMMA LOG YES ☑ NO ☐

CERTIFICATION
WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER

SIGNATURE
JOURNEYMAN NO. VA 3721 DATE May 3 19 88

WELL OWNER

ANTICIPATED WATER REQUIREMENT:
GALLONS/LITRES PER DAY
I HAVE RECEIVED A COPY OF THIS REPORT.
SIGNATURE
DATE 19

ALBERTA ENVIRONMENT COPY

WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO: DIRECTOR OF EARTH SCIENCES ALBERTA ENVIRONMENT

① CONTRACTOR

NAME: Alta. Environment
ADDRESS: 10405 - Jasper Ave.
Edmonton, Alta

② WELL OWNER

NAME: Alta. Env. (L.H. Butcher)
ADDRESS: Duvernay, Alta
2489-E

⑩ LOCATION

1/4	SEC.	TWP.	RGE.	WEST OF MERIDIAN
15	22	55	12	W4

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

LICENCE NO: 524
DATE STARTED: May 3 19 88
DATE COMPLETED: May 5 19 88

WELL COMPLETION DATA

③ DESIGN:
OPEN HOLE: BLOTTED CASING:
SCREEN: GRAVEL PACK:
DIAMETER OF HOLE: 5 7/8"
BOTTOMED IN: CLAY: SAND:
SANDSTONE: SHALE: COAL:
DEPTH TO TOP OF BEDROCK: 19'
TOTAL DEPTH: 68'

③ CASING:
TYPE: Steel inserts
SIZE O.D.: 5 9/16 WALL THICKNESS: .188
BOTTOM SET AT: 54.5 FT/M

④ SEAL: YES ☑ NO ☐
DEPTH OF SEAL: 54.5 FT/M
DESCRIPTION: Cement grout from surface to 54.5' River pipe

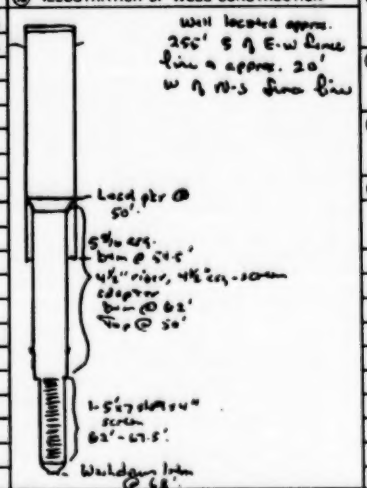
⑤ SCREEN: YES ☑ NO ☐
TYPE: Steel inserts
SIZE O.D.: 4 1/2"
WALL THICKNESS: .156
BOTTOM AT: 68 FT/M TOP AT: 50 FT/M
PERFORATED FROM: ____ FT/M TO ____ FT/M
River pipe to 4"(cement-sand adapter (3')
HOW PERFORATED: SAWCH ☐
MACHINE ☐ OTHER ☐
SIZE PERFORATIONS: IN/MM BY IN/MM

⑥ GRAVEL PACK: YES ☑ NO ☐
SIZE: 12-20 AMOUNT: 4 gal.

⑦ SCREEN: YES ☑ NO ☐
MATERIAL: Stainless steel
SIZE I.D. (CLEAR): 4"
LENGTH: 5'
SLOT SIZE: 7
62 FT/M 67.5 FT/M
FITTINGS TOP: River pipe - Steel ptr. - cement-sand adapter
FITTINGS BOTTOM: Waldom bottom
METHOD OF INSTALLATION: Attached to Waldom bottom - Lowered down hole on drill string

⑧ PUMP: YES ☐ NO ☐
TYPE: H.P.
SIZE: VOLTAGE:
DROP PIPE SIZE: LENGTH:
MATERIAL:
SCREEN AT: FT/M

⑨ ILLUSTRATION OF WELL CONSTRUCTION


Well located approx. 255' S of E-W Line line & approx. 20' W of N-S line line
Steel ptr @ 50'
5 9/16 csg. bottom @ 54.5'
4½" riser, 4½" csg.-sand adapter bottom @ 62' Top @ 50'
4½" slotted screen 62'-67.5'
Waldom bottom @ 68'

⑪ FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	
GROUND LEVEL	2	topsoil
2	3	gravel
3	14	silty brown clay
14	19	silty grey clay
19	55	silt
55	68	silt

⑪ ELECTRIC LOG: YES ☐ NO ☑
GAMMA LOG: YES ☐ NO ☑

⑫ TYPE OF WELL:

ROTARY ☑ BORED ☐ CABLE TOOL ☐
JET ☐ DUG ☐ OTHER ☐

⑬ TYPE OF WORK:

NEW WELL ☑ DEEPEN ☐ TEST HOLE ☐
RECONDITION ☐ ABANDON ☐

⑭ PROPOSED USE:

DOMESTIC ☐ STOCK ☐ IRRIGATION ☐
MUNICIPAL ☐ INDUSTRIAL ☐ OBSERVATION ☑

⑰ PRODUCTION TEST (PUMPING AT A CONSTANT RATE)

TIME	WATER LEVEL WHILE PUMPING FT	WATER LEVEL RECOVERED FT
0	11.11	
30 SEC	11.81	14.00
1 MIN	12.26	13.55
1 MIN. 30 SEC	12.59	13.29
2 MIN.	12.83	13.07
3	13.19	12.76
4	13.45	12.54
5	13.62	12.38
6	13.76	12.26
7	13.86	12.17
8	13.96	12.10
9	14.00	12.04
10	14.05	11.99
12	14.13	11.91
14	14.20	11.84
16	14.25	11.785
18	14.30	11.745
20	14.35	11.705
25	14.41	11.63
30	14.47	11.58
35	14.515	11.53
40	14.56	11.47
50	14.625	11.41
60	14.67	11.355
75	14.735	11.30
90	14.79	11.24
105	14.85	11.20
120	14.905	

PUMP ☑ BAILER ☐ AIR ☐
NON-PUMPING WATER LEVEL: 11.11 FT/M
RATE OF YIELD: 6 (G.P.M.) L.P.M.
DURATION OF TEST (MIN. 2 HR. TEST): 2 HRS. 0 MINS.
PUMPING WATER LEVEL OR BAILING LEVEL: ____ FT/M
TOTAL DRAWDOWN AT END OF TEST: 3.795 FT/M
PUMP SET AT: 55 FT/M
RECOMMENDED PUMPING RATE: 6 (G.P.M.) L.P.M.
ADDITIONAL PRODUCTION TEST INFO: YES (NO)
Rest of time drilling

⑱ WATER QUALITY:

CHEMICAL ANALYSIS: YES ☑ NO ☐
BACTERIAL ANALYSIS: YES ☐ NO ☑
WATER TEMPERATURE: 6.55°C
OTHER:

CERTIFICATION
WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER.

SIGNATURE: [signature]
JOURNEYMAN NO.: VA 7721 DATE: May 5 19 88

WELL OWNER

ANTICIPATED WATER REQUIREMENT: _____ GALLONS/LITRES PER DAY
I HAVE RECEIVED A COPY OF THIS REPORT.
SIGNATURE: _____
DATE: _____ 19 ____

ALBERTA ENVIRONMENT COPY

WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO: DIRECTOR OF EARTH SCIENCES ALBERTA ENVIRONMENT

① CONTRACTOR

NAME: Alta Environment
ADDRESS: 10405 - Jasper Ave.
Edmonton, Alta

LICENCE NO. 524
DATE STARTED: May 4 19 88
DATE COMPLETED: May 5 19 88

② WELL OWNER

NAME: Alta Fav. (L.H. Butcher)
ADDRESS: Drayton, Alta
2490 - E

⑫ LOCATION

1/4	SEC.	TWP.	RGE.	WEST OF MERIDIAN
1	22	55	12	W4

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

WELL COMPLETION DATA

② DESIGN:
OPEN HOLE ☐ SLOTTED CASING ☐
SCREEN ☐ GRAVEL PACK ☐
DIAMETER OF HOLE:
BOTTOMED IN: CLAY ☐ SAND ☐
SANDSTONE ☐ SHALE ☐ COAL ☐
DEPTH TO TOP OF BEDROCK:
TOTAL DEPTH:

③ CASING:
TYPE:
SIZE O.D. WALL THICKNESS:
BOTTOM SET AT: FT/M

④ SEAL: YES ☐ NO ☐
DEPTH OF SEAL: FT/M
DESCRIPTION:

⑤ LINER: YES ☐ NO ☐
TYPE:
SIZE O.D.
WALL THICKNESS:
BOTTOM AT: FT/M TOP AT: FT/M
PERFORATED FROM: FT/M TO: FT/M

HOW PERFORATED: TORCH ☐
MACHINE ☐ OTHER ☐
SIZE PERFORATIONS: IN/MM BY IN/MM

⑥ SAND PACK: YES ☐ NO ☐
SIZE: AMOUNT:

⑦ SCREEN: YES ☐ NO ☐
MATERIAL:
SIZE I.D. (CLEAR):
LENGTH:
SLOT SIZE: FT/M FT/M
FITTINGS TOP:
FITTINGS BOTTOM:
METHOD OF INSTALLATION:

⑧ PUMP: YES ☐ NO ☐
TYPE: H.P.:
SIZE: VOLTAGE:
DROP PIPE SIZE: LENGTH:
MATERIAL:
INTAKE AT: FT/M

⑨ ILLUSTRATION OF WELL CONSTRUCTION

Test hole

Test hole abandoned with Bentonite

Test hole approx. 250' W of Highway 26 - approx. 50' E of N-S fence line on west side of gravel pit.

⑩ TYPE OF WELL:

ROTARY ☑ BORED ☐ CABLE-TOOL ☐
JET ☐ DUG ☐ OTHER ☐

⑪ TYPE OF WORK:

NEW WELL ☐ DEEPEN ☐ TEST HOLE ☑
RECONDITION ☐ ABANDON ☐

⑬ PROPOSED USE:

DOMESTIC ☐ STOCK ☐ IRRIGATION ☐
MUNICIPAL ☐ INDUSTRIAL ☐ OBSERVATION ☐

⑪ FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	FORMATION LOG DESCRIPTION
GROUND LEVEL	9	gvl
9	19	sd
19	39	sltystn
39	48	sltystn
48	50	slty clay
50	87	cly
87	99	sst
99	115	sst
115	119	sh
119	139	sh/sst interbed
139	156	sst
156	179	sh

⑫ ELECTRIC LOG: YES ☑ NO ☐
GAMMA LOG: YES ☑ NO ☐

⑰ PRODUCTION TEST (PUMPING AT A CONSTANT RATE)

TIME	WATER LEVEL WHILE PUMPING FT/M	WATER LEVEL RECOVERY FT/M
0		
30 SEC.		
1 MIN.		
1 MIN. 30 SEC.		
2 MIN.		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
18		
20		
25		
30		
35		
40		
50		
60		
75		
90		
105		
120		

PUMP ☐ BAILER ☐ AIR ☐
NON-PUMPING WATER LEVEL: FT/M
RATE OF YIELD: I.G.P.M. /L.P.M.
DURATION OF TEST (MIN. 2 HR TEST): HRS. MINS.
PUMPING WATER LEVEL OR BAILING LEVEL: FT/M
TOTAL DRAWDOWN AT END OF TEST: FT/M
PUMP SET AT: FT/M
RECOMMENDED PUMPING RATE: I.G.P.M. /L.P.M.
ADDITIONAL PRODUCTION TEST INFO: YES/NO

⑭ WATER QUALITY

CHEMICAL ANALYSIS: YES ☐ NO ☐
BACTERIAL ANALYSIS: YES ☐ NO ☐
WATER TEMPERATURE:
OTHER:

CERTIFICATION
WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER.

SIGNATURE: [signature]
JOURNEYMAN NO. VA 3321 DATE May 5 19 88

WELL OWNER

ANTICIPATED WATER REQUIREMENT:
_____ GALLONS/LITRES PER DAY
I HAVE RECEIVED A COPY OF THIS REPORT.
SIGNATURE _____
DATE _____ 19 _____

ALBERTA ENVIRONMENT COPY